PLN-20

Environmental Monitoring Plan for the Pantex Plant

July 7, 1995

Work Performed Under Contract No. DE-AC09-91AL65030

Prepared for
U. S. Department of Energy
Albuquerque Operations Office
Amarillo Area Office

Prepared by
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Amarillo, TX 79177

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produce and publish an Annual Site Environmental Report. In performing these functions, the EPD ensures that the Pantex Plant remains in compliance with environmental requirements.

The remainder of Section 1 presents the design rationale in a historical context. Section 2 describes the effluent monitoring for those facilities that have the potential to discharge. It includes discussion of sampling systems, locations, frequencies, and analyses. Section 3 describes environmental surveillance including the media sampled, locations and frequency of sampling, sample analysis, data reporting and analysis, and changes for 1995. Section 4 describes the meteorological data support provided by onsite systems. Section 5 discusses quality assurance of the various aspects of the EMP, including considerations in the field and in the laboratory. Section 6 discusses laboratory procedures for various kinds of analyses. Included in this section are discussions of sample holding times and sample custody control. Section 7 describes the data management, data validation, and statistical analysis procedures used by the EMP.

1.1 PROGRAM DESIGN

This section provides a historical review of the different factors that have influenced the design of the EMP. The EMP is flexible and accommodates changes, but before proposed changes to the program are put into effect, how the changes relate to the original factors must be considered. The design rationale balanced legal concerns, public interests, and state and local commitments with a scientific approach to assess environmental conditions. Future revisions to the monitoring plan will consider a systematic approach of pathways analysis based on source terms to quantify exposure/risk assessment.

The current program has developed from general sampling for radiation surveillance, as specified by Atomic Energy Commission Manual Chapter 0513, "Effluent and Environmental Monitoring and Reporting." Monitoring activities prior to 1973 are summarized in the Pantex Plant Environmental Assessment (DOE 1976). Descriptions of the EMP activities can also be found in the Annual Site Environmental Reports for 1971 through 1994. (The title has varied over the years.) The oldest portion of the EMP is drinking water sampling, with records dating from the World War II era of the Plant. The drinking water program has been modified many times in order to remain in compliance with the Safe Drinking Water Act.

With [redacted] the DOE, new orders were issued that directed the EMP. DOE Order 5480.1, "Envi[redacted]ction, Safety, and Health Protection Program for DOE Operations," provided generic guida[redacted] facilities. In addition to requiring the preparation of this plan, DOE Order 5400.1 contained requirements and guidance in Chapter IV, "Environmental Monitoring Requirements," that are implemented in this Environmental Monitoring Plan. The major requirements were collection of baseline data to allow five-year comparisons of data and specific quality assurance requirements. DOE Order 5400.5, "Radiation Protection of the Public and the Environment," established additional standards and requirements, which are addressed within this plan. The DOE's "Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance" (DOE 1991) influenced the structure and conduct of the EMP for radiation concerns and served as a best management guide for the remainder of the program. A number of activity-specific procedures emphasizing analysis of nonradioactive constituents (primarily solvents and metals) result from protocols recommended by the EPA and the Texas Natural Resource Conservation Commission (TNRCC) and/or its predecessors . An example is 40 CFR 264.97, "General Ground-water Monitoring Requirements." In addition, operations at the Pantex Plant have involved a variety of explosive compounds, which are also target analytes.

In support of preparing the Pantex Plant Environmental Impact Statement (DOE 1983), a study entitled "Radiation Monitoring and Radiological Assessment of Routine Releases" was performed by the Los Alamos National Laboratory (Buhl et al. 1982). The study concluded that the then-existing EMP results should be considered background levels, as the radiation activities were not above the laboratory detection limits. Monitoring was performed for a depleted uranium test shot, *in situ* gamma spectra of soils, and garden samples from Claude, Texas. In addition, a helicopter survey quantified levels of direct radiation in soil.

An environmental survey was conducted by DOE/Headquarters in November 1986 (DOE 1987). This comprehensive survey identified some deficiencies in the EMP. A State of Texas requirement for monitoring fluoride in air and vegetation was identified as a deficiency with consequent actions taken to implement a sampling program. Also, a deficiency was identified in that the 1985 thermoluminescent dosimeter readings differed from the state readings (1985 was the first year measurements were obtained for the Pantex Plant). The second phase of the environmental survey involved active sampling of suspected areas, which included the installation of one perched monitoring well. The results of this sampling are presented in five volumes (DOE 1988a,b,c,d, 1989).

The environmental survey was the predecessor for the current Environmental Restoration Program. After the environmental survey sampling activities were completed, DOE/Albuquerque Operations Office established the Comprehensive Environmental Assessment and Restoration Program. At the Pantex Plant, two investigations of leaking underground storage tanks and one investigation of the solvent pits at the Burning Ground were conducted, with a report issued in June 1989. Three Ogallala monitoring wells were installed at the Burning Ground in September 1989. In October 1989, the lead for the Environmental Restoration Program was given to the U.S. Army Corps of Engineers, Tulsa District, with Pantex support provided for logistical issues. Occasionally, co-samples of Environmental Restoration wells are taken for the EMP, when requested by the DOE/Amarillo Area Office.

Pantex Plant underwent a "Tiger Team" review in October 1989 that resulted in 12 findings related to environmental monitoring and subsequent changes to the EMP (DOE 1990). The Tiger Team quality assurance finding QA/BMPF-1, which relates to best management practices, found that the Pantex Plant had not developed a written Environmental Monitoring Plan to formally direct and update its ongoing EMP. This lack was identified as the root cause for the other 11 environmental findings and the action plan for correction served as a paradigm for resolution of all 12 findings. As of January 1994, all Tiger Team findings have been closed. The 11 additional Tiger Team findings were as follow:

AIR/CF-1	Inadequate fluoride forage monitoring
AIR/CF-2	Inadequate monitoring of atmospheric fluoride releases
AIR/BMPF-2	Air monitoring siting requirements and aiming
SW/CF-3	Untimely reporting of Texas Water Commission (TWC) wastewater discharge permit exceedance
SW/BMPF-4	Unrepresentative wastewater flow measurements
GW/BMPF-1	Inadequate groundwater monitoring
QA/BMPF-2	Inadequate sampling protocols
QA/BMPF-3	Inadequate sampling techniques
RAD/BMPF-3	Lack of annual land use census

RAD/BMPF-4 Pantex annual environmental monitoring report inadequacies
CNR/CF-1 Lack of wetlands environmental review.

A Progress Assessment Team from the DOE Office of Nuclear Safety visited March 15–26, 1993. This visit was a follow-up to the 1989 Tiger Team visit. Two concerns and one strength were identified. The concerns were the technical validity of monitoring procedures and the DOE/Amarillo Area Office's day-to-day oversight of the Waste Management and Environmental Monitoring Programs. The area of strength was the subcontract analytical laboratory program. Finding E/C-1 noted that "[t]he M&H system in place to ensure that environmental monitoring procedures are technically accurate, complete, and consistent is ineffective." A decision was made to have an independent needs assessment performed to identify the strengths and weaknesses of the EPD. The goal was to use the results of the needs assessment in restructuring the EPD to address the root cause for Finding E/C-1. The needs assessment was performed April 13-14, 1993, by Pacific Northwest Laboratory (PNL) staff, with documentation of observations and recommendations completed April 27, 1993. A more far-reaching consequence of the needs assessment was the decision to develop an Environmental Protection Program Manual (EPPM) (Mason & Hanger 1993) to provide documentation of management philosophy, responsibilities, and program structure for environmental protection activities. PNL assistance was utilized in developing the initial EPPM. Table 1.1 is a summary matrix of the observations, recommended actions, and the status of implementing the actions. Future actions include the continued development of the EPPM and expanded use of Continuous Improvement Teams.

Additional oversight of the EMP has been performed by the DOE/Albuquerque Operations Office and DOE/Amarillo Area Office. Surveillance reports and/or findings are provided and consequent action plans prepared. The EPD maintains a file of all such oversight, as changes to the EMP commonly result. Additional oversight by DOE/Headquarters included a Technical Safety Appraisal in January 1992. Minor findings were issued in regard to meteorological monitoring. The meteorological monitoring was started in 1986 when the existing station was added to the Lawrence Livermore National Laboratory-Atmospheric Release Advisory Capability system. The findings required increased documentation for operations.

As a result of a 1989 TNRCC Resource Conservation and Recovery Act (RCRA) inspection, corrective actions were implemented at the 11-14 Pond. After the sludge and liner were removed, three rounds of soil sampling were performed. Because the results were inconclusive, four wells were installed. Solvents not found in the pond were found in the perched groundwater. As a result, future actions for this facility have been combined with other environmental restoration activities.

Negotiations between DOE and the U.S. Environmental Protection Agency (EPA) began in October 1989 and resulted in the issuance of a RCRA Section 3008(h) Administrative Order of Consent by EPA Region 6 on December 10, 1990. The Order was the result of a visual site assessment conducted in January 1988, which relied heavily on the results of the environmental survey. The Order required that all discharges from Buildings 11-44, 12-17, and 12-41 and the 11-14 Pond be stopped. The Order also required that "DOE shall collect samples at the discharge point(s) of Buildings ... 12-19, 12-43, and 11-50 if these units are discharging aqueous wastestreams to the land surface ... twice over a period of sixty (60) days." A sampling and analysis plan was submitted on January 21, 1991, and approved June 13, 1991. Sampling occurred on June 28 and August 26, 1991. The EPA and the TNRCC co-sampled on August 26. On April 20, 1992, the EPA approved the final report required by the Order. The requirements from the sampling and analysis plan were incorporated into Section 2.1 of this plan for liquid effluent monitoring activities.

Table 1.1 Summary of Needs Assessment Observations and Recommendations

Observation	Recommended Actions	Status
1. The Environmental Monitoring Plan for the Pantex Plant (IOP D4100) has not been used effectively to provide direction for the environmental monitoring program.	The Environmental Monitoring Plan should be removed from the EPD Internal Operating Procedures and made a program-level document with Plant-wide visibility.	This plan is a Plant-wide document and has been circulated for broad review.
2. The Operations Quality Program Plan for Environmental Monitoring (QP-ENSH-07) written by M&H to support the Environmental Monitoring Program does not provide (1) adequate detail to ensure implementation or (2) applicable requirements from QAMS-005.	a. Develop a "strawman" Quality Assurance Plan (QAP) to support the Pantex Environmental Monitoring Program.	"Strawman" QAP (PX-MNL-00044, "QA Manual for Pantex Environmential Monitoring") received May 1993 from PNL.
	b. Review the current environmental monitoring program and identify what organization/positions/individuals are responsible for performing the actions identified in the strawman QAP.	Observation addressed in the EPPM.
	c. Evaluate the adequacy and effectiveness of the environmental monitoring program elements currently in place and implemented.	Discussed in PX-MNL-00044, "QA Manual for Pantex Environmential Monitoring."
3. No single individual has been dedicated full-time to the coordination, implementation, and development of the Environmental Monitoring Program.	Provide for a full-time Environmental Monitoring Program manager.	Observation addressed in the EPPM.
4. Lower-level documents need to be written to implement the Environmental Monitoring Plan in several areas.	a. Review and evaluate environmental monitoring sampling procedures for adequacy against the requirements of EPA protocols and DOE Orders.	Procedures reissued February 1, 1994. Data Quality Objective process formalized.
	b. Evaluate the system currently being used to validate environmental monitoring data packages.	New procedures prepared. Additional staff hired.
	c. Provide a summary of training requirements for sampling personnel based on Code of Federal Regulations.	Departmental training coordinator hired.

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A Grant in Aid v ... eptember 1, 1990, for a five-year hydrogeologic char ... on study at the Plant with ... Texas at Austin Bureau of Economic Geology (... the lead agency. The Gec ... nt of the University of Texas at Austin and the Water ... s Center at Texas Tech U... orting agencies. Final deliverables include a long-term groundwater monitoring plan designe ... ed by the City of Amarillo to the north of the Plant. The ... d into future ... ing plan and the DOE Order 540 ... n Manageme ... interim deliverables (technical r ... includes monitoring at two wells that were installed by

The Amarillo National Resource Ce ... am was established in October 1994 to supp ... ssues critical to the Plan ... ientists and engineers at Texas Tech Unive ... schools in the Univ ... ystems, ... Texas State ... ort the ... on Program i ... element

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Committee Act. The Board's monthly meeting is open to the public; the date, location, and time are announced in the Federal Register two weeks prior to the meeting and also reported by the local news media.

As a result of Pantex Plant being listed on the National Priorities List in May 1994, a trusteeship of representatives from federal and Texas agencies was formed in December 1994. This trusteeship is charged with assessing natural resource damages resulting from Pantex Plant operations and determining and implementing mitigation measures that may be needed.

In response to the Defense Nuclear Facility Safety Board Finding 90-2, the Pantex Plant performed an extensive compliance assessment of DOE Orders. The assessments of DOE Orders 5400.1 and 5400.5 were performed in September 1991, with the corrective actions for EMP requirements for which compliance was not demonstrated incorporated into the original version of this plan. A summary was provided in the preface of the July 2, 1992, version of this plan. Full compliance with the EMP requirements in DOE Order 5400.1 was achieved in September 1993; compliance with those in DOE Order 5400.5 was achieved in January 1994.

During 1992 the Pantex Plant buildings were ranked according to their potential accident hazard. Of the 363 buildings at the Plant, 99 fall into low or moderate hazard status and require Safety Analysis Reports (SAR). Details of the SAR process, and consequent Operational Readiness Review process, can be found in the Integrated Risk Management Program Manual (Mason & Hanger 1994). Five non-reactor nuclear facility buildings exist at Pantex Plant; these are Zone 4 Magazines, Building 12-26 Pit Vault, Building 12-42 South Vault, Building 12-44 Cell 8, and Building 12-58 Bays 4 and 5. This list does not include the bays and cells that are nuclear explosive facilities with their own special requirements. The EMP activities specific to individual facilities are described in the respective SARs and collectively herein. The EMP surveillance activities are not described in SARs, but rather are cross-referenced to this plan.

Sampling of wastewater, as required by the wastewater no-discharge permit issued by the TNRCC in 1980 and amended in 1988, was the original regulatory driver for monitoring activities. Table 1.2 lists the current status of permits for the Pantex Plant. It is anticipated that extensive changes to the master sampling and analysis schedule will be required when each of the new or revised permits is issued. Details of the changes to the EMP are provided in the respective sections of this plan. A concise history of permit activities is provided in a chapter on compliance in the Annual Site Environmental Reports.

In February 1994, the DOE issued a Finding of No Significant Impact (FONSI) for the interim storage of plutonium at Pantex (DOE 1994). As part of the FONSI, commitments were made to

- Prepare a sitewide Environmental Impact Statement
- Enhance public participation in review of the adequacy of the environmental monitoring program
- Conduct a baseline study of ambient radiation levels in Zone 4.

In response to these commitments, the DOE/Amarillo Area Office has opened discussions with the Pantex Plant Citizens' Advisory Board and neighbors in regard to enhanced community monitoring. The initial sampling activities will involve residential water supplies, Additional proposed activities are discussed within this plan.

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	TX-4890110527 HW-50284	EPA, TNRCC	04-25-1991	25-2001
Hazardous Waste Permit	Class III Modification	EPA, TNRCC	Application under review	
		Medium: Water		
Wastewater No-Discharge Permit	02296	TNRCC	05-19-1980	3-1993
Wastewater Discharge Perm		TNRCC		
NPDES' Permit	7107	EPA		
Stormwater	7107			
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On May 31, 1994, Pantex was added to the National Priorities List by the EPA after being a proposed site since July 1991. This designation as a Superfund site has no initial impact on the EMP.

1.2 MANAGEMENT OVERVIEW

The EPPM (Mason & Hanger 1993) was drafted to describe all areas of environmental protection that have been assigned to the EPD by Pantex Plant line management. In general, the scope of EPD activities may be described by two broad areas of environmental protection — environmental monitoring and environmental compliance. Two Pantex Plant Policy Directives, DIR-3026, "Environmental Monitoring Program," and DIR-3032, "Environmental Compliance," are the primary internal Pantex Plant drivers for environmental protection. The EPPM consists of an overall project plan and detailed chapters for each program element. Items addressed include drivers, budget, deliverables, records, reporting, operational considerations, and long-range plans. In addition, details are provided for the AIP, training, quality assurance, and other program aspects that are common to all program elements.

The EMP elements can be characterized by interactions involving environmental monitoring data generated by the Environmental Protection Program. At the basic (primary) level, the data collection/generation element is responsible for the sampling and monitoring that produces the environmental data necessary to support the Environmental Protection Program. Staff from this program element collect data for all media, oversee analytical laboratories producing the data, and are responsible for validating the accuracy of data for higher-level users, as well as producing data compilation reports and designing and updating the Integrated Environmental Database. Staff prepare and maintain a list of current Internal Operating Procedures (IOPs; Appendix A), the "Quality Assurance Plan for Environmental Monitoring" (PX-MNL-00044), and the "Environmental Monitoring Master Plan for Routine Sampling" (PX-MNL-00045), and they contribute to other plans as necessary to ensure that the monitoring requirements of various users are met.

The next program level (secondary) is the media-directed program elements (surface water, groundwater, drinking water, air quality, soil, flora, fauna), which are focused on specific media-related programs and the data supporting these program elements. "Media managers" are responsible for designing the sampling and monitoring program for a specific medium, seeing that the design is implemented appropriately by performing surveillances, audits, or inspections, and interpreting and using data (e.g., in trend analysis).

The tertiary level contains program elements (natural resources, environmental radiation, permitting, compliance, public interaction, regulator interface, support to production) that are typically broader in scope than the media-directed program elements and are, therefore, called multidisciplinary program elements. In general, these program elements use data from any or all of the media-directed program elements; however, there are exceptions. All of the tertiary program elements depend on the primary and secondary program elements for necessary data and information and must work closely with these program elements to see that the data generated are appropriate. Figure 1.1 depicts how these broad characterizations of program elements describe implementation of the Environmental Protection Program.

Tertiary	**Multidisciplinary Program Elements** Natural Resources Environmental Radiation Permitting Compliance Public Interaction Regulator Interfaces Support to Production
Secondary	**Media-Directed Program Elements** Surface Water Groundwater Drinking Water Air Quality Soil Flora Fauna
Primary	**Data Collection/Generation** Sampling Analysis Data Validation Data Management Reporting

Figure 1.1 Levels of Data Used in the Environmental Protection Program

1.3 REFERENCES

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Treatment Facility Permit 02296 limits wastewater discharge to Playa One and Playa Two to an average not to exceed 650,000 gallons per day. The permit specifies water quality limits for four sampling locations: at the point of discharge after chlorination, and at each of the three drainage ditches downstream from Zones 11 and 12, as shown in Table 2.1. Liquid effluent flow rates are also recorded at a number of locations as a requirement of the permit.

Additional liquid effluent sampling was initiated as a result of draft Section 3008(h) of the Administrative Order of Consent to Pantex Plant, issued by the U.S. Environmental Protection Agency (EPA) Region 6 on September 7, 1989. The final terms of the Order became effective December 10, 1990. Two interim measures contained within the Order drive portions of the liquid effluent monitoring program at the Pantex Plant. The first action required was to cease release of aqueous waste streams containing hazardous waste or hazardous waste constituents from Buildings 12-17, 12-41, and 11-44, and the 11-14 Pond to the land surface. The second action involved sampling of the discharges from Buildings 12-19, 12-43, and 11-50.

The Pantex Plant has used the above regulatory-driven actions as a cornerstone of the liquid effluent sampling program, but has expanded the sampling activities well beyond these requirements, under the impetus of requirements for environmental monitoring in DOE Order 5400.1. Many of the additional sampling and analysis activities were initiated at the Pantex Plant during 1990.

2.1.2 Sampling and Laboratory Analysis

The Pantex Plant liquid effluent sampling program was modified in 1990 to reflect the more extensive liquid effluent monitoring requirements mandated in DOE Order 5400.1. Since 1990, all Plant discharge locations have been sampled to detect the presence of hazardous and/or radioactive constituents.

The purpose of routine liquid effluent sampling is to characterize liquid effluent discharges and demonstrate compliance with applicable DOE Orders and with federal and State of Texas regulations. Sampling at some locations is required under terms of the State of Texas wastewater no-discharge permit. Characteristic data will be used to evaluate the applicability of the National Pollution Discharge Elimination System (NPDES) permit application process to the Pantex Plant and allow the continuation of Plant operations during the investigative and corrective stages of the RCRA Facility Investigations. In addition, sampling helps to establish a baseline for Plant discharges. This baseline can be used to determine changes in Plant effluents or the presence of new effluent sources.

The primary type of liquid effluent sampling done at the Pantex Plant is off-line periodic sampling, more commonly referred to as "grab sampling." Samples are randomly collected within a given period, typically one month for radioactive and hazardous constituents of effluent streams. This type of sampling is suitable for ensuring that concentrations of contaminants in effluent streams have not changed significantly and that contaminants have not been introduced to previously uncontaminated waste streams. Because of the nature of Pantex operations, concentrations of contaminants in liquid effluent waste streams are reasonably constant when facilities are operating.

The only sampling performed that is not grab sampling is conducted at the Wastewater Treatment Facility (WWTF). There, an automated sampler continuously collects a sample over a 6-hour period twice per week, to be analyzed for concentrations of heavy metals. This sampling is both continuous and periodic; it is adequate to verify the absence of metals from the normally uncontaminated wastewater stream.

Table 2.1 Water Quality Conditions for Wastewater No-Discharge Permit Number 02296

Location	Pollutant	30-Day Average, mg/ml	Never to Exceed in Grab Sample, mg/L
Discharge after chlorination	BOD	50	150
Zone 12 West	COD		300
Zone 12 East	COD		300
16-1 Weir	COD		300
All locations	pH		not less than 6.0 nor greater than 9.0 at any time (based on grab sample)

Liquid effluent flow rates from various facilities may be quite variable, depending on the activity of operations in these facilities. Many Pantex operations are intermittent and generate a discontinuous process flow. However, when operations are active in the facilities, effluent flow rates are reasonably constant during operating hours and when sampling is done, even though they may vary widely during a 24-hour period.

Flow is monitored at various locations throughout Pantex Plant. Liquid effluent monitoring is conducted at the 12-17 and 12-19 weirs and at Buildings 12-43, 11-20, and 11-50. The instrumentation is inspected to verify that it is operational, to remove debris, and to record the volume of water released.

2.1.2.1 Sampling Locations

Liquid effluent samples are collected at nine locations (see Table 2.2). Eight of these locations sample the process wastewater from buildings. The other location, at the WWTF, provides a sample from the Plant-wide sanitary sewage system. These locations are shown in Figure 2.1.

Sampling locations at Buildings 12-19, 12-43, and 11-50 were originally mandated by EPA Order 3008(h), and sampling has been expanded and included in the Pantex routine sampling program. Sampling at Buildings 12-17 and 11-44 continues to verify compliance with the "cease and desist" provisions of Order 3008(h).

2.1.2.2 Sample Frequency

Samples are collected randomly within the periods listed in Table 2.3. Building discharges and flows through ditches, weirs, and flumes, which may be intermittent, are sampled during flow.

Samplin

s

			yes
	, 12-7		yes
	11-36		no
	11-20 occasionally	sampling 50 yards downstream (NE) in ditch	yes
	11-50		yes
WWTF	Plant sanitary sewage	sampling at incoming weir, lagoon, and chlorine contact chamber discharge to	yes

Table 2.3

Daily

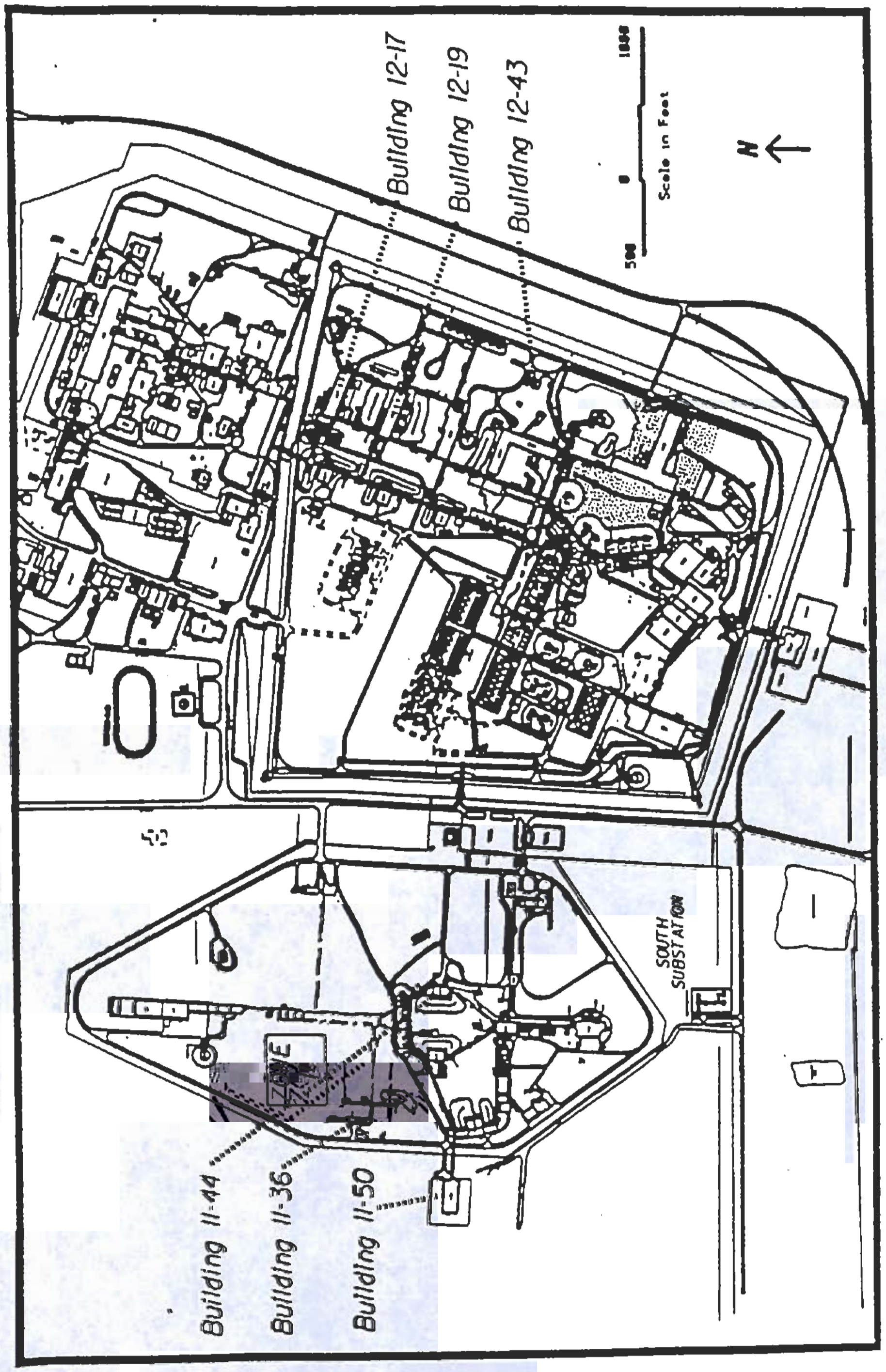

Figure 2.1 Effluent Sampling Locations in Zones 11 and 12

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A limited a ... at the Pantex Plant. Most samples ... n Section 6.

2.1.2.4 Data Review and Reporting

Routine data are reviewed for gross accuracy when returned from the contract laboratory. Analytical results are tabulated when received and reviewed for accuracy and for trends (using outlier tests or other statistical procedures). Control charts are used to aid in the interpretation of results. Data are then published in the Annual Site Environmental Report.

2.1.3 Characterization of Effluent Streams

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Table 2.4 Sample Analyses Performed for Each Pantex Facility Liquid Effluent

Building	Sampling Location	pH & Temp.	Metals	VOC	HE	Hex. Cr	TSS	TDS	Cl^-	SO_4^-	TOC	Ammonia as N	Oil & Grease	Radio-nuclides
12-17	12-17N 12-17S	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	— X
12-19	12-19N 12-19S	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	 X
12-24	12-43	X	X	X	X	X	X	X	X	X	X	X	X	X
12-78	12-43	X	X	X	X	X	X	X	X	X	X	X	X	X
11-20	11-44	X	X	X	X	X	X	X	X	X	X	X	X	X
11-36	11-36	X	X	X	X	X	X	X	X	X	X	X	X	X
11-50	11-50	X	X	X	X	X	X	X	X	X	X	X	X	X
Wastewater Treatment Facility	Inflow Lagoon DAC	X	X	X	X	X	X	X	X	X	X	X	X	X

2.2 AIRBORNE EFFLUENT MONITORING

Nearly all monitoring and sampling of possible airborne effluents at the Pantex Plant is currently done as part of environmental surveillance activities at remote locations both onsite and offsite. This sampling program is described in Section 3. Operational activities that are sources or potential sources of air pollution are described in Appendix B.

Monitoring for potential releases of airborne effluents from Pantex facilities has historically been done at remote locations, primarily because of the lack of discrete release points from Pantex facilities and the low potential for routine release. The nature of the work at the Pantex Plant and the physical form of the material does not generate large quantities of airborne material.

2.2.1 Radiological Air Effluent Monitoring

Pantex Plant assembly and disassembly areas contain radiological monitoring equipment to detect the presence of tritium or alpha contamination released into the cell. This equipment is designed primarily for occupational/radiological safety considerations, however, and would be useful only for alerting Pantex staff of the release of radioactive material inside the cell. It would not be useful for determining whether radioactive material reached the environment, or for quantifying a release.

Strategies are being developed for upgrading the airborne radiological environmental surveillance program. The document "Plan for Monitoring Airborne Radionuclide Emissions Other Than Radon from Pantex" (Mason & Hanger 1994) describes the proposed upgrade, which will be submitted to EPA for review. Pantex Plant has begun unilateral deployment of some of the elements of this plan. Further revisions to this plan are in development in consultation with DOE, TNRCC, and the public.

2.2.2 Nonradiological Air Effluent Monitoring

The Pantex Plant currently conducts air monitoring for radionuclides only. A plan for conducting nonradiological monitoring has been developed and will be implemented when funds are budgeted.

While processes in Buildings 11-36, 12-19, 12-108 and 16-3 are subject to TNRCC air permits, these permits do not require effluent (stack) monitoring. Emission estimates are developed using process information and accepted emission factors for these processes.

Fugitive emissions monitoring will be required when operations begin in Building 11-55. Construction of this building began in mid-1994.

Should Pantex Plant become subject to a Title V federal operating permit, source monitoring may be required.

As part of the Agreement in Principle between the State of Texas and DOE, TNRCC conducts monitoring of the air at five locations on Plant property. These monitoring sites monitor for hydrogen fluoride, VOCs, particulate matter in air as PM-10 (particles 10 microns or less in size), wind speed and direction, and total suspended particulates. The total suspended particulate samples are sent to the Texas Department of

Health-Bureau of Radiation Control for radiological analysis. These data are published by the TNRCC on a quarterly basis.

2.2.3 Quality Assurance

Pantex Plant has a quality assurance program in compliance with DOE Order 5700.6C. The existing program will incorporate specific EPA and TNRCC requirements for air sampling when such sampling is implemented, and a Pantex-specific quality assurance plan will be prepared.

2.3 REFERENCES

DOE. 1991. **Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance**. DOE/EH-0173T. January 1991.

Mason & Hanger. 1991. **Surface Water Monitoring Program.** June 1991.

Mason & Hanger. 1994. **Plan for Monitoring Airborne Radionuclide Emissions Other Than Radon from Pantex**. Draft. August 1994.

3.0 ENVIRONMENTAL SURVEILLANCE

Environmental surveillance activities are described in detail in the Annual Site Environmental Report. Data from the surveillance program are used to assess radiation exposure and risk to the public and to demonstrate compliance with applicable regulations. Environmental surveillance involves the collection and analysis of samples of air, surface water, groundwater, soil, flora, and fauna and the measurement of penetrating radiation. Quality assurance (QA) is discussed in Sections 5.0, 6.0, and 7.0, a list of current procedures is provided at Appendix A, and the QA plan has been published (PX-MNL-0044). Each medium-specific subsection below discusses the locations to be sampled, frequency of sampling, analyses to be performed, and review and reporting of data. The overall sampling schedule for the Environmental Monitoring Program is listed in PX-MNL-00045.

3.1 AIR SAMPLING

Current monitoring for airborne radionuclide emissions at the Pantex Plant has been described (Mason & Hanger 1994). Details for the collection of ambient air samples for radiological analysis are given in Internal Operating Procedure (IOP) D-4150, "Air Sampling Procedure." A system of 17 perimeter (fence-line) monitoring sites became operational at the end of FY94. High-volume samplers for uranium and plutonium isotopes located at these fence-line sites are operated and the resultant data treated in the same way as other samplers in the system. The new tritium monitors at the fence-line sites sample for both elemental tritium and tritium oxide. Operation of these new tritium monitors will be specified in a revision to IOP D-4150. In addition, the Texas Natural Resources Conservation Commission (TNRCC) operates five air samples at Pantex. Sampling is performed for total suspended particulates, PM-10, volatile organic compounds, and fluoride.

3.1.1 Air Sampling Locations

Ten offsite air sampling stations surround Pantex Plant. Predecessor agencies to the U.S. Department of Engergy (DOE) required that air samplers be placed on a five-mile radius around the site. Stations OA-AR-01 through OA-AR-06 and OA-AR-08 through OA-AR-10 were placed about five miles from the Pantex Plant. Because winds are predominantly from the south to southwest. sampling stations were concentrated to the north and northeast of the Plant. A control station (OA-AR-13) was established upwind at the U.S. Department of Agriculture - Agricultural Research Service (USDA-ARS) Bushland Station.

Onsite monitoring stations were placed near operating areas where airborne releases might occur. Stations PA-AR-01 through PA-OA-05 were located around firing sites to monitor areas where depleted uranium hemispheres bonded to high-explosive components were tested. Station PA-AR-06 was located adjacent to Building 12-42, where nuclear components were handled, and station PA-AR-07 was located adjacent to Building 4-26 to monitor shipping and receiving activities.

The 17 fence-line monitoring sites have been chosen according to the specifications set out in the "Plan for Monitoring Airborne Radionuclide Emissions Other Than Radon from Pantex" (Mason & Hanger 1994), and in consultation with the DOE and the public.

Table 3.1 Air Monitoring Locations

Location ID	Description
Onsite	
PA-AR-01	W of Water Well 17
PA-AR-02	W of Old Water Treatment Building
PA-AR-03	SW of Water Well 6
PA-AR-04	Adjacent to N fence of E Side of Zone 4
PA-AR-05	Adjacent to Pantex N fence on FM 293
PA-AR-06	E of Building 12-42
PA-AR-07	NE of Building 4-26, W side of Zone 4
Offsite	
OA-AR-01	2.0 miles N of intersection of FM 2373 and FM 293, 3.0 miles W, 0.2 mile N, 0.2 mile W
OA-AR-02	2.0 miles N of intersection of FM 2373 and FM 293, 2.0 mile W, 1.3 miles N
OA-AR-03	2.3 miles N of intersection of FM 2373 and FM 293
OA-AR-04	2.0 miles N of intersection of FM 2373 and FM 293, 2.0 miles E, 1.0 mile N, 0.3 mile W, SW corner
OA-AR-05	1.5 miles E of intersection of FM 2373 and FM 293, 0.4 mile N
OA-AR-06	4.1 miles E of intersection of FM 2373 and US 60, S fence line
OA-AR-08	2.3 miles S of intersection of FM 2373 and US 60, SE corner of intersection at fence
OA-AR-09	intersection of FM 683 and US 60, NW corner
OA-AR-10	2.2 miles W of intersection of FM 683 and FM 245, N fence
OA-AR-13	Bushland Station

The locations of onsite samplers are listed in Table 3.1 and shown in Figure 3.1. The locations of the fence-line monitoring sites are also shown in Figure 3.1. Offsite air sampling locations are listed in Table 3.1 and shown in Figure 3.2. The tenth offsite location is at the USDA-ARS Bushland Station.

Radionuclides that could potentially be released as a result of normal operations at Pantex Plant include uranium and tritium. Plutonium could be released only in the event of an accident. Each sampling site is equipped with continuously operating high-volume and low-volume samplers that collect particulate samples. Filters from the high-volume samplers are analyzed for uranium and plutonium. The low-volume system uses equipment that allows both elemental tritium and tritium oxide to be collected on silica gel traps.

3.1.2 Air Sampling Frequency

The frequency of air sample collection, types of samples, and analyses performed are summarized in Table 3.2.

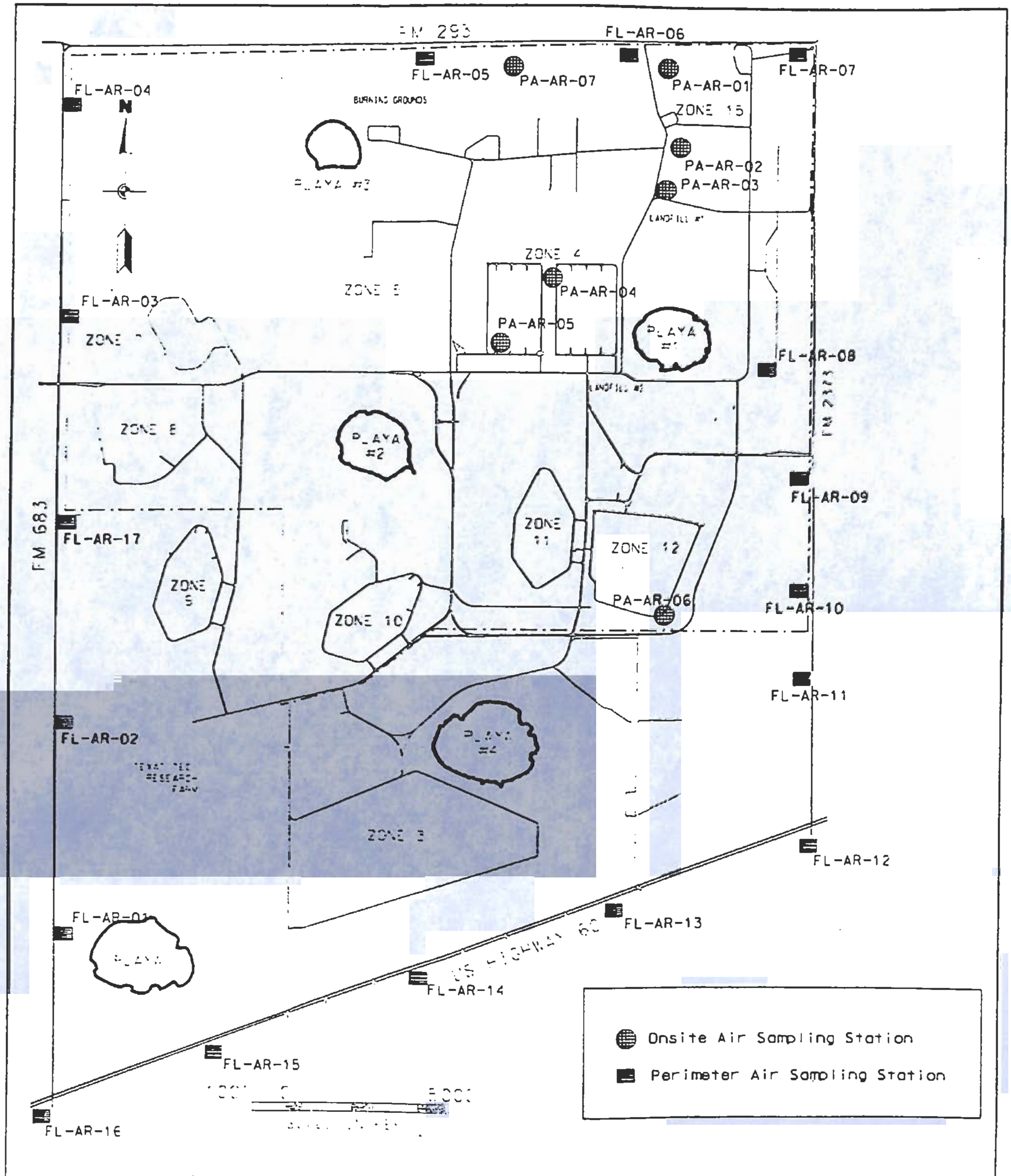


Figure 3.1 Onsite and Fence-Line Air Sampling Locations

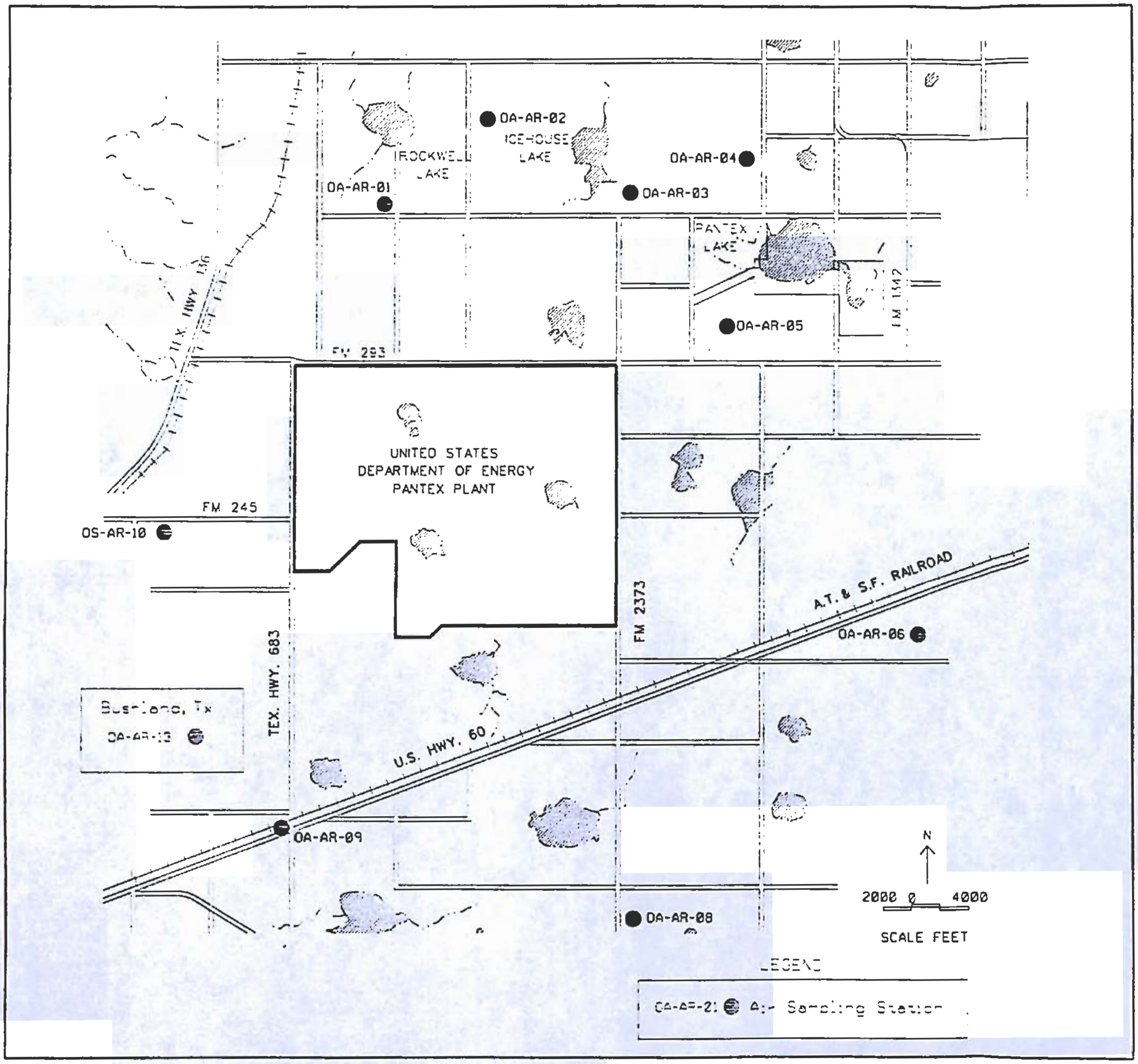


Figure 3.2 Offsite Air Monitoring Locations

3.1.3 Air Sample Analyses

Low-volume pre-filters from the onsite and offsite monitoring locations are screened on Plant for gross alpha and beta activity using a low-background alpha/beta detector, in accordance with IOP D-0001, "Screening of Low-Volume Air Pre-Filters for Gross Alpha/Beta Activity." The composited filters from the high-volume particulate samplers are analyzed for uranium-234, uranium-238, and plutonium-239/240 (combined plutonium-239 and plutonium-240) at an offsite commercial laboratory. The silica gel moisture traps are analyzed for tritium using liquid scintillation counting at an offsite commercial laboratory. The types of analyses performed on air samples are summarized in Table 3.2.

3.1.4 Data Review and Reporting

Analytical results are tabulated when received from the contract laboratory and reviewed for proper methodology, precision, and accuracy. Data validated by this process are published in data compilations, each covering at least one month's previously unpublished data. Air data published in the data compilation are reviewed by the media manager for air, who prepares the air section of the interpretation report for DOE once each month. This report includes analysis according to IOP 16, "Environmental Monitoring Data Trending Procedures." Results are reported in the Annual Site Environmental Report.

3.1.5 Air Sampling Changes and Special Projects Planned

3.1.5.1 Equipment Upgrade

To meet the requirements of 40 CFR 61, Subpart H, National Emission Standards for Hazardous Air Pollutants (NESHAP) for Radionuclide Emission from DOE Facilities, the radiological air monitoring program will be reevaluated and upgraded as necessary. This includes reviewing the locations of onsite and offsite monitoring stations.

3.1.5.2 NESHAP Review

The Subpart H NESHAP requirements established emission standards for specific radionuclides and nonradioactive pollutants. The Pantex Plant air surveillance program will be evaluated against specific details of the NESHAP amendments.

3.1.5.3 Possible Expansion of Air Monitoring at Pantex

As mentioned in Section 2.2.1, revision of the "Plan for Monitoring Airborne Radionuclide Emissions Other Than Radon from Pantex Plant" (Mason & Hanger 1994) is planned. This revision may require expansion of the Pantex air monitoring system if EPA Region 6 so requires. As discussed in section 2.2.2, nonradiological monitoring may occur. Plans for the expansion of radiological and/or nonradiological monitoring at the Pantex Plant will be developed through consultation with regulators, DOE, and the public.

An additional driver for the expansion of the offsite air sampling network is the commitment made when the Secretary of Energy issued the Finding of No Significant Impact for Interim Storage of Plutonium (DOE 1994) to deploy enhanced radiation detection equipment. The Pantex Plant response to this com-

Table 3.2 Summary Schedule for Air Sampling and Analysis

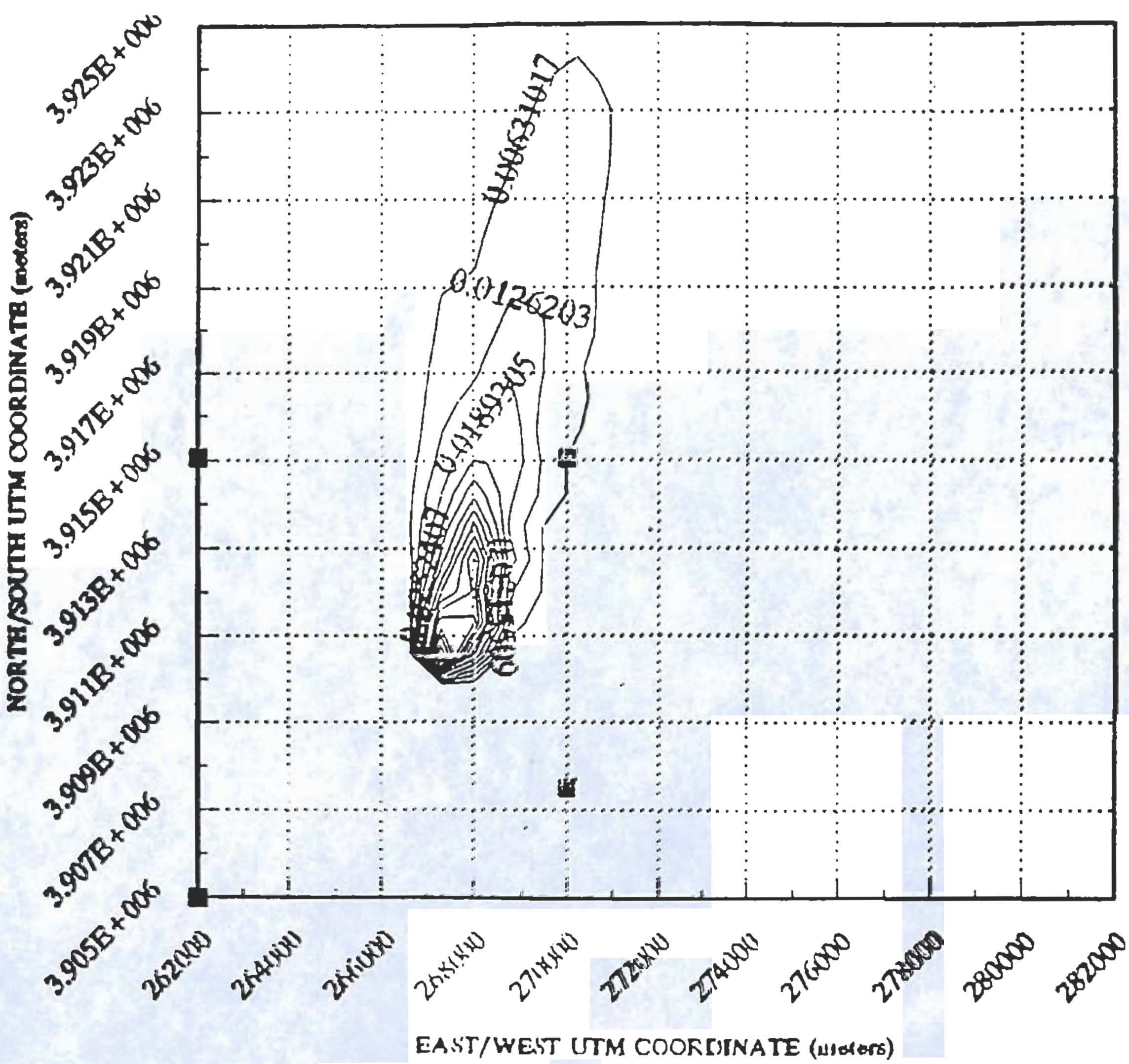
Locations	Sample Type	Sample Frequency	Analyses
Onsite	Particulate filter	Collected weekly; analyzed monthly	Uranium-234; Uranium-238; Plutonium-239/240
	Pre-filter	Weekly	Gross alpha/beta
	Silica gel	Weekly	Tritium
Offsite	Particulate filter	Collected weekly; analyzed monthly	Uranium-234; Uranium-238; Plutonium-239/240
	Pre-filter	Weekly	Gross alpha/beta
	Silica gel	Weekly	Tritium
Fence Line	*	*	*

* The fence-line radiological monitors will be operated on a schedule similar to that for onsite and offsite locations. Due to the presence of the improved tritium monitors at the fence-line sites, sampling frequencies may differ from those at the onsite and offsite locations.

mitment was to explore the deployment of about eight additional tritium low-volume air monitoring stations. The additional stations will complement the existing air monitoring stations and will measure concentration of radionuclides at critical receptor locations, if the following criteria are met:

(1) the neighbor consents to an easement,
(2) the neighbor is preferentially within most probable drift direction,
(3) the air sampler can detect the expected tritium concentrations, and
(4) those criteria listed in EPA/600/4-77/027a, "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods," are met.

Because the Pantex Plant lacks distinct, continous "point sources" with direct, measurable emissions, direct point source monitoring is impractical. Emissions will vary over time and location. However, the most accurate method of dose calculation at nearby receptor points is through the use of actual concentration measurements at these locations [40 CFR 61.93(b)(5)]. Modeling of downwind dispersion and subsequent dose commitment calculations has been performed to select the most appropriate locations. After determining that an inversion on a cold winter day would be the worst case, the Pantex Plant modelled a hypothetical accidental release of 40,000 curies of tritium for January 14, 1988, using the Industrial Source Complex Short-Term Computer (ISCII) Code. January 14, 1988, was chosen because on that day Pantex experienced the lowest mixing heights and coolest ambient temperature recorded. Figure 3.3 illustrates how the tritium concentration would vary over a 32 by 32 kilometer (20 by 20 mile) area. The hypothetical plume originated at Building 12-44-1, which lies at the center of the contour graph. The plume would (1) hypothetically stay near the nape of the earth [approximately 20 meters (65 feet)] during an inversion; (2) disperse/diffuse along a narrow path; (3) widen slightly as it transverses



*Note that the contour lines have the dimensions of microcuries per cubic meter.

Figure 3.3 Tritium Air Concentration at Pantex After Hypothetical Accidental Release of 40,000 Curies of Tritium from Building 12-44-1 on January 14, 1988 t data

reeme

(fiu

be a direct

ation) because over time soil can accumulate radioactive

d from air and water. This section addresses the rationale for and methods of the

su ogram for the Pantex Plant.

E illance of soils is conducted on and off the Pantex Plant site. The soil surveillance

pr veloped to monitor both short- and long-term effects of Plant operations and to detect

ar uclides from Plant operations.

D rganizations required th und a site,

and soil samples w e originally collected at t

established along t

Plant. Later, sam

Ground to monitor routine operati

Since 1978 the soil surveillance pr 31 offsite

locations and 19 onsite locations. A control location was 1981

94, the his ffsite results were examined a

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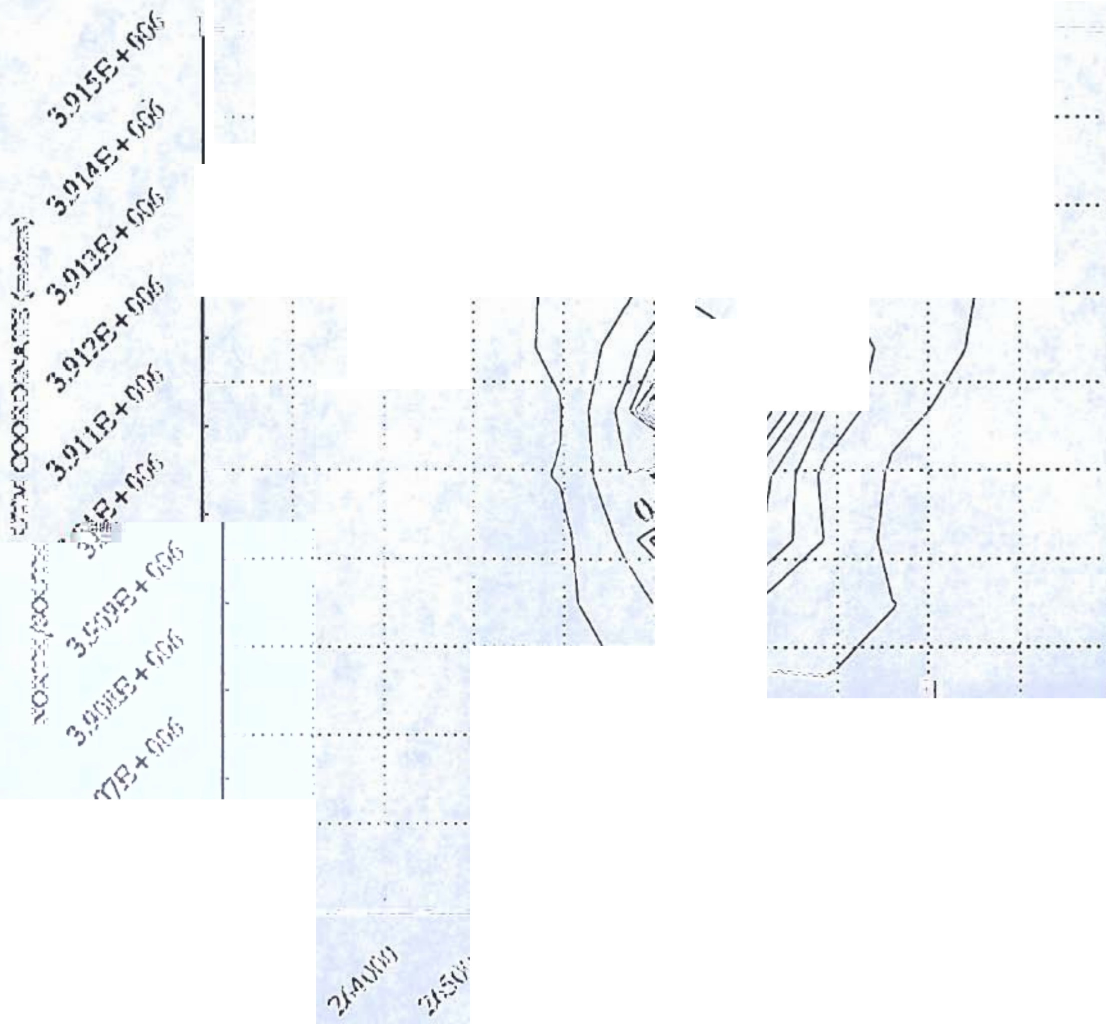
3.915E+006
3.914E+006
3.913E+006
3.912E+006
3.911E+006
3.909E+006
3.908E+006

Further additions to the soil surveillance program have been proposed for FY95 to meet the requirements of the Pantex Plant Discharge Permit and commitments made by the Secretary of Energy concerning the Zone 4 Stage Right Finding of No Significant Impact.

Details for collecting surface soil samples are given in IOP D-4235, "Soil Sampling Procedures."

3.2.1 Soil Sampling Locations

Onsite, there are 35 surface soil locations, as listed in Table 3.3 and shown in Figures 3.5 and 3.6. There are 17 offsite surface soil locations and as listed in Table 3.4 and shown in Figure 3.7, including two control locations at the USDA-ARS Bushland Station. Surface soil samples are collected at the Bushland sampling location.

3.2.2 Soil Sampling Frequency

The frequency of collection of soil samples is summarized in Table 3.5.

3.2.3 Soil Sample Analyses

The types of analyses performed are summarized in Table 3.5 and the analytes are listed in Table 3.6.

3.2.3.1 Radiological Soil Sample Analysis

Routine soil samples are analyzed for uranium-234, uranium-238, plutonium-239/240, and tritium because these are the radionuclides handled at the Pantex Plant. Alpha spectrometry analysis is performed by an offsite laboratory. Tritum activities are determined by liquid scintillation analysis after water is recovered from a soil sample. Laboratory data are used as Quality Level III, as discussed in Section 7.2.

3.2.3.2 Nonradiological Soil Sample Analysis

Routine soil samples from the Burning Ground area and Bushland are analyzed for constituents that have the potential to be released as listed in the proposed Resource Conservation and Recovery Act (RCRA) permit for operations at the Burning Grounds. Metals (aluminum, boron, cadmium, chromium, cobalt, copper, magnesium, manganese, molybdenum, nickel, silver, zinc) are analyzed by inductively coupled argon plasma spectroscopy at an offsite laboratory according to the EPA directive (ion-specific methods). Mercury is analyzed by cold vapor analysis at off-site laboratory. The routine playa surface soil samples are analyzed for RCRA-listed metals and volatile organic compounds (benzene, 1,1,1-trichloroethane, carbon tetrachloride, chlorobenzene, chloroform, ethylbenzene, o-xylene, toluene, trichlorofluoromethane, trichloroethylene, styrene, bromomethane, perchloroethylene, 1,2-dibromoethane, methylene chloride, vinyl chloride, 1,2-dichloroethane, 1,2-dichloropropane, 1,3-butadiene) and HEs (HMX, PETN, RDX, TNT). Metals are analyzed as above, and volatile organic compounds and HE residues are analyzed by chromatography by an offsite laboratory, according to EPA directive (compound-specific methods). Laboratory data are used as Quality Level III, as discussed in Section 7.2.

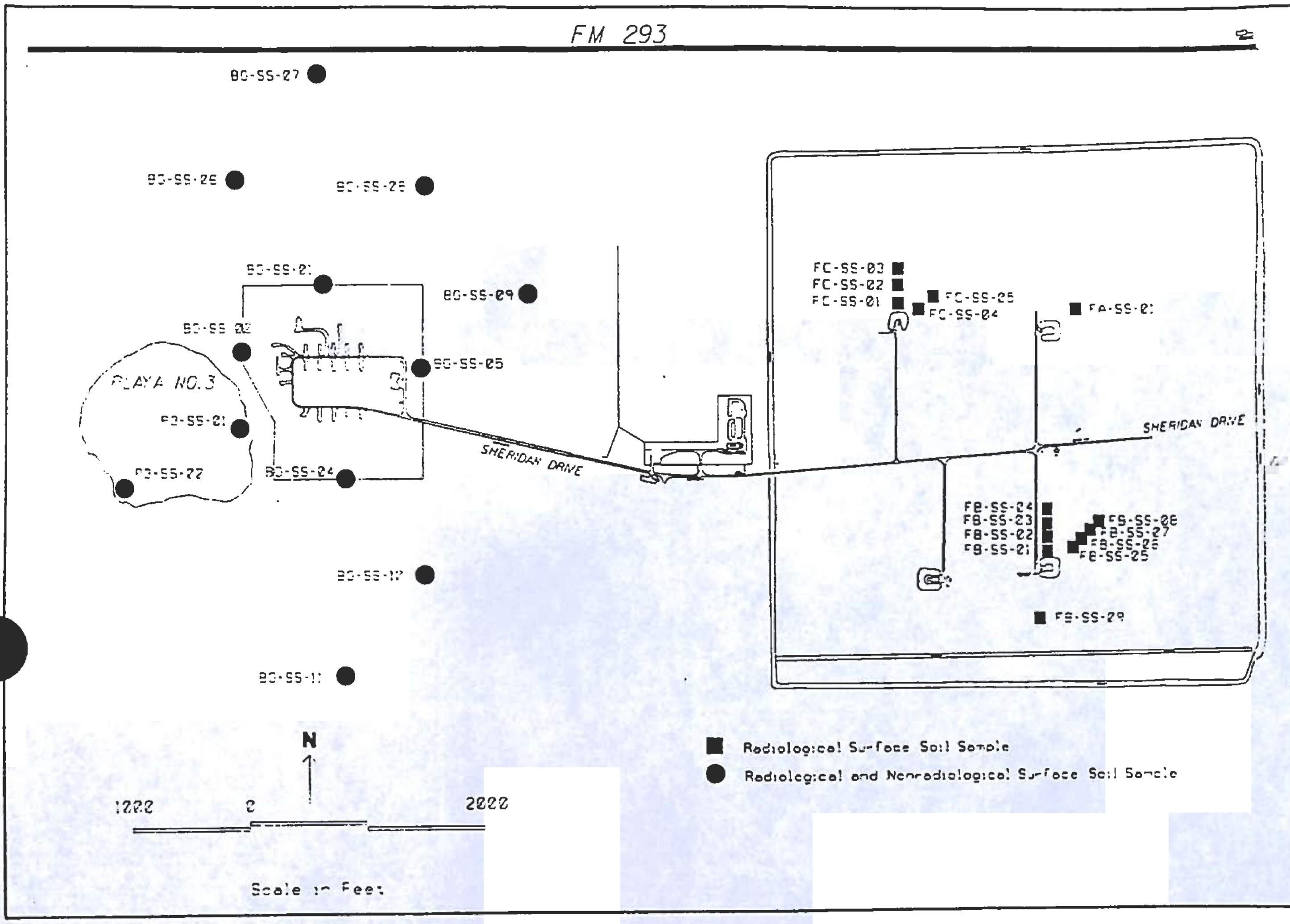

Figure 3.5 Routine Soil Surveillance Locations at Burning Ground and Firing Sites

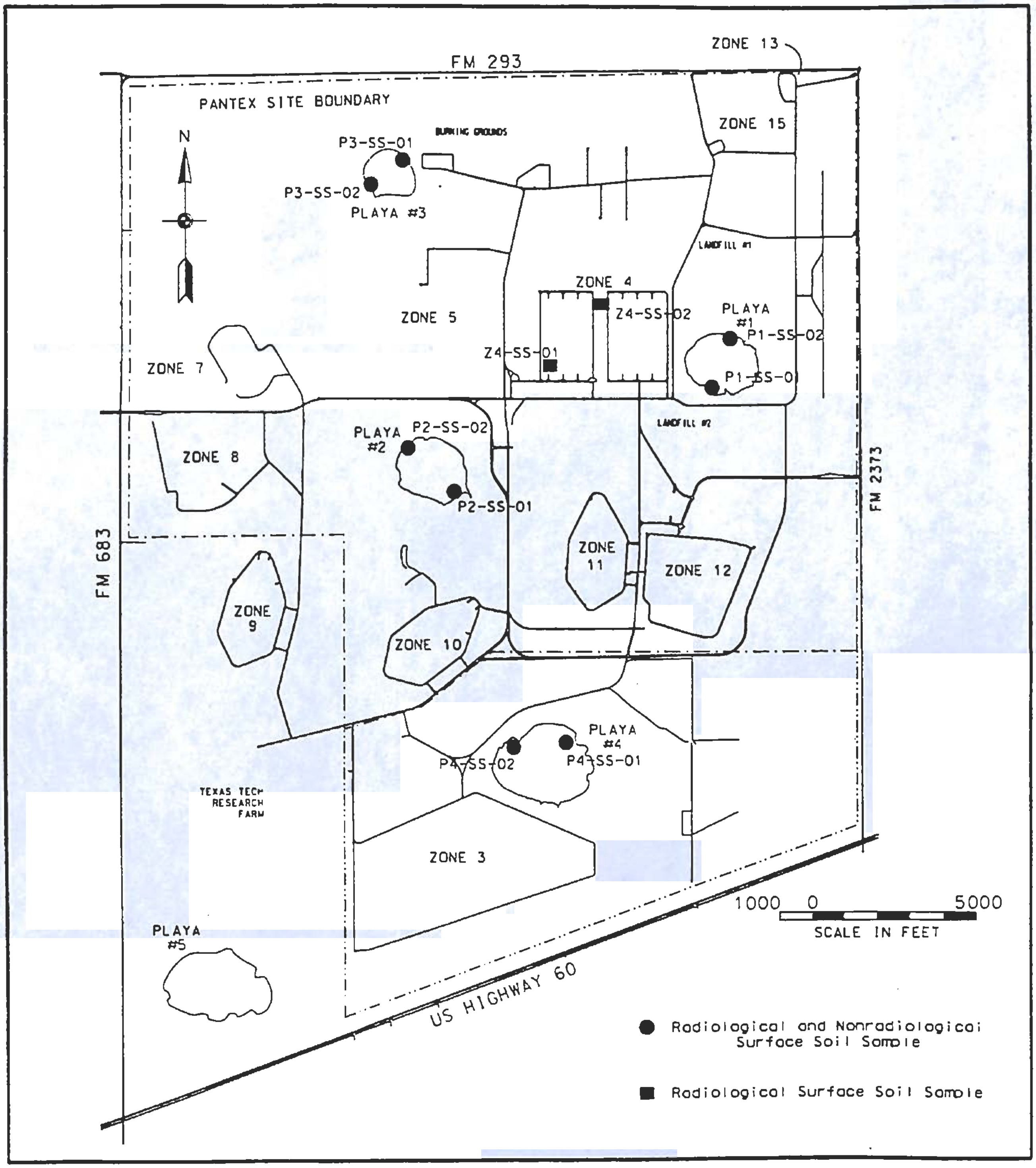

Figure 3.6 Routine Soil Surveillance Locations for Playas and Zone 4

Table 3.5 Summary Schedule for Soil Sampling and Analysis

Locations*	Sample Frequency	Analyses†
Burning Ground	Monthly	Uranium-234, Uranium-238, Plutonium-239/240, Tritium, Metals
Firing Sites	Monthly	Uranium-234, Uranium-238, Plutonium-239/240
Zone 4	Quarterly	Uranium-234, Uranium-238, Plutonium-239/240
Playa 3	Monthly	Uranium-234, Uranium-238, Plutonium-239/240, Tritium, HE, Metals, VOCs
Playas 1,2,4	Bimonthly	Uranium-234, Uranium-238, Plutonium-239/240, Tritium, HE, Metals, VOCs
Bushland	Monthly	Uranium-234, Uranium-238, Plutonium-239/240, Tritium, HE, Metals
Bushland Playa	Monthly	Uranium-234, Uranium-238, Plutonium-239/240, Tritium, HE, Metals, VOCs
Offsite	Quarterly	Uranium-234, Uranium-238, Plutonium-239/240

* Specific locations are listed in Table 3.3.
† High explosives (HE), metals, and volatile organic compounds (VOC) analytes are listed in Table 3.6.

3.2.5.2 Baseline Soil Data

Baseline information for onsite soils has not been established, and the reference concentrations of selected contaminants is unknown. Thirteen-year averages for total soil uranium and three-year averages for uranium-234 and uranium-238 were compiled for the 19 offsite soil sampling stations (Honea and Gabocy 1991). The data establish reference levels for uranium in the Pullman soil, one of the predominant soils of the Texas Panhandle. A long-term study in conjunction with the Environmental Restoration Program is being considered, to characterize the background concentrations for contaminant species of concern in soils and surface water. The data will be useful in deciding if the levels of radioactivity and concentrations of heavy metals in Pantex soils and surface water are the result of industrial operations/contamination or natural geochemical processes.

3.2.5.3 Uranium in Pullman Soils of the Texas Panhandle

The 1991 report by Honea and Gabocy concerning the levels of uranium in Pullman soils will be updated in FY95. The original report concerned mostly data for total uranium. The updated report will address historical uranium-234 and uranium-238 data, from 1988 through 1993. Studies conducted in FY94 will also allow discussion of uranium chemistry in the Pullman soil and preliminary results of expanded offsite

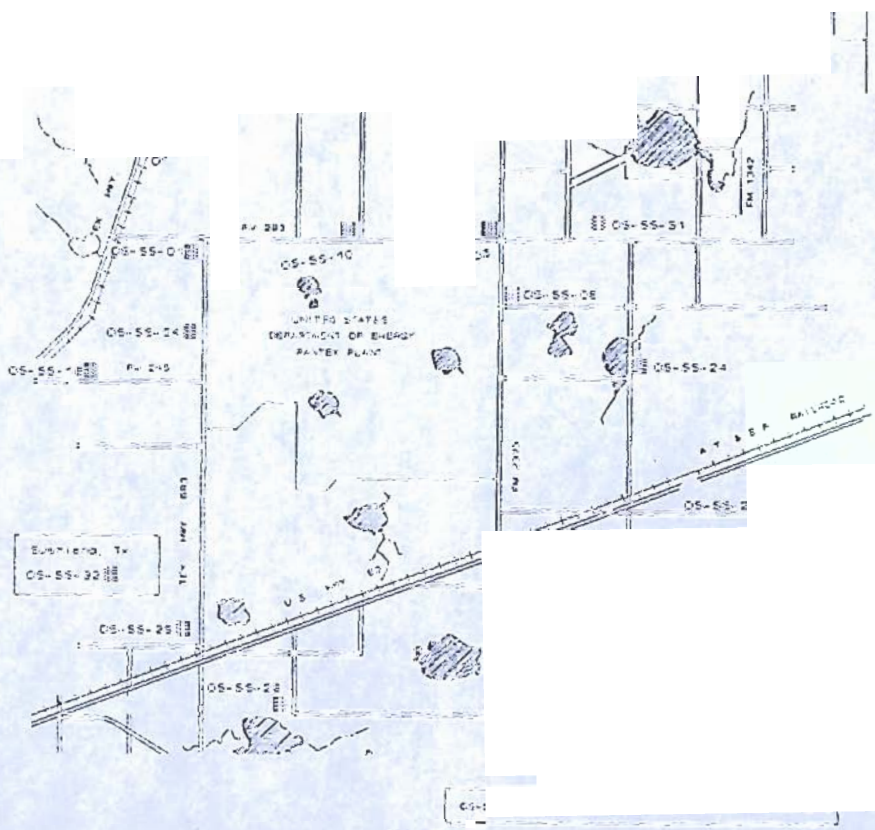
OS-SS-01
OS-SS-10
OS-SS-31
UNITED STATES
DEPARTMENT OF ENERGY
PANTEX PLANT
FM 1342
OS-SS-06
OS-SS-24
OS-SS-18
Bushland, TX
OS-SS-32
OS-SS-25
OS-SS-22

Table 3.6 Metal Analytes and Characterization Parameters for Soils

<u>Metal Analytes</u>

Aluminum	Manganese
Boron	Mercury
Cadmium	Molybdenum
Chromium	Nickel
Cobalt	Silver
Copper	Zinc
Magnesium	

<u>Volatile Organic Compound Analytes</u>

Benzene	Styrene
1,1,1-trichloroethane	Bromomethane
Carbon tetrachloride	Perchloroethylene
Chlorobenzene	1,2-dibromoethane
Chloroform	Methylene chloride
Ethylbenzene	Vinyl chloride
O-xylene	1,2-dichloroethane
Toluene	1,2-dichloropropane
Trichlorofluoromethane	1,3-butadiene
Trichloroethylene	

<u>High Explosive Analytes</u>

HMX	RDX
PETN	TNT

<u>Radionuclides</u>

Uranium-234	Plutonium-239/240
Uranium-238	Tritium

3.3.2 Flora Sampling Frequency

As listed in Table 3.8, flora samples for fluoride analysis are collected four times during the late growing season. Onsite flora samples for radiological analysis are collected monthly, and offsite samples for radiological analysis are collected quarterly.

3.3.3 Flora Sample Analyses

Analyses performed on flora samples are summarized in Table 3.8. Flora samples (vegetation and crop) collected from the vicinity of the Burning Ground are analyzed for inorganic fluoride according to Method 14-A found in the Texas Natural Resource Conservation Commission (TNRCC) Laboratory Methods Manual. Flora samples for radiological analysis are sent to an offsite analytical laboratory and analyzed for uranium-234 and uranium-238 by alpha spectrometry and tritium by liquid scintillation. Alpha spectrometry analysis is performed by an offsite laboratory according to EPA direction (40 CFR 61 Appendix B Method 114). Laboratory data are used as Quality Level III, as discussed in Section 7.2.

3.3.4 Data Review and Reporting

Data are produced by an onsite laboratory or offsite-contract laboratories and delivered to the Sampling and Analysis Section for validation. The raw data and required QA results are examined thoroughly to determine if DQOs developed by the media manager are realized. Validated data are reviewed by the media manager according to IOP 16. Control charts and statistical procedures appropriate to the field are used to identify trends or shifts in the data (Section 7.3). Data are reviewed on a monthly basis, and a monthly interpretation report discusses nonradiological and radiological results, which are submitted along with historical statistical limits.

3.3.5 Flora Sampling Changes and Special Projects Planned for FY 1995

3.3.5.1 Crop Sampling for Radiological Analysis

An analysis is being made of the feasibility of additional monitoring of crops for radiological and fluoride analysis near the Burning Ground. Even though previous work (Wenzel et al. 1982) did not identify a concern, two samples will be taken during the growing season: one in the early vegetative stage and one prior to harvest. Samples to be analyzed would consist of roots, forage, and grain for hard red winter wheat and sorghum (grain or forage). Sampling procedures will be included in a revision to IOP D-4260. Sampling locations will be developed in conjunction with a public consultation process. All routine crop sampling locations will be evaluated relative to recommendations by the American Society for Testing and Materials (ASTM) for site-selection criteria. Analytical data from all onsite and offsite sampling locations will be compared with historical and control location data. Changes in sampling frequency and location may be recommended based on these comparisons.

3.3.5.2 Expanded Offsite Sampling

At the same time as the Secretary of Energy's commitment to the increase in weapons components storage in the Zone 4 area, offsite environmental surveillance to assess the potential impacts on the public and the environment was proposed. It was proposed that, at the request of landowners and occupants, envi-

Table 3.7 Pantex Vegetation Monitoring Locations

Sample ID	Location
Burning Ground	
BG-VS-01	NE of NW pad
BG-CR-01	S of SW Burning Ground fence-line corner
BG-CR-02	300 feet E of SW fence-line corner
BG-CR-03	650 feet E of SW fence-line corner
BG-CR-04	950 feet E of SW fence-line corner
BG-CR-05	S of SE Burning Ground fence-line corner
BG-CR-06	E of SE Burning Ground fence-line corner
BG-CR-07	400 feet N of SE fence-line corner
BG-CR-08	900 feet N of SE fence-line corner
BG-CR-09	450 feet S of NE fence-line corner
BG-CR-10	E of NE Burning Ground fence-line corner
BG-CR-11	N of NE Burning Ground fence-line corner
BG-CR-12	400 feet W of NE fence-line corner
BG-CR-13	800 feet W of NE fence-line corner
BG-CR-14	400 feet E of NW fence-line corner
BG-CR-15	N of NW Burning Ground fence-line corner
BG-CR-16	100 feet S and 400 feet W of NW corner
BG-CR-17	900 feet W of NW fence-line corner
BG-CR-18	200 feet N and 700 feet W of NW corner
BG-CR-19	350 feet N and 950 feet W of NW corner
BG-CR-20	500 feet N and 1500 feet W of NW corner
BG-CR-21	1800 feet N of BG-CR-13 on N Plant fence
BG-CR-22	1800 feet N and 900 feet E of NE corner
BG-CR-23	900 feet N of NE fence-line corner
BG-CR-24	900 feet E of NE fence-line corner
P3-VS-01	NW area of Playa Three
P3-VS-02	NE area of Playa Three
P3-VS-03	Center of Playa Three
PS-VS-04	SW area of Playa Three
P3-VS-05	SE area of Playa Three

Table 3.7 (continued)

Sample ID	Location
Firing Site 5	
FB-VS-01	300 feet NW of site
FB-VS-02	250 feet N of site
FB-VS-03	400 feet S of site
Firing Site 10	
FC-VS-01	300 feet NE of site
Offsite	
OV-VS-01	Intersection of FM 683 and FM 245
OV-VS-02	NE of intersection of FM 2373 and FM 293
OV-VS-03	1.6 miles W of intersection of FM 683 and FM 293
OV-VS-04	1 mile W of intersection of FM 683 and FM 293
OV-VS-05	NE of intersection of FM 683 and FM 293
OV-VS-06	NE of OV-VS-05
OV-VS-07	2 miles W of City of Amarillo well #616
OV-VS-08	3.4 miles E on FM 293
OV-VS-09	SE of intersection of FM 2373 and FM 293
OV-VS-10	NE of intersection of FM 2373 and US 60
OV-VS-11	2.6 miles S of intersection of US 60 and FM 2161
OV-VS-12	2.8 miles south of intersection of US 60 and FM 2373
OV-VS-13	NE of OV-VS-12
OV-VS-14	Intersection of US 60 and FM 683
OV-VS-15	NE of City of Amarillo well #616
OV-VS-16	Adjacent to Plant's N fence
Offsite Control	
OV-VS-17	Bushland, Texas

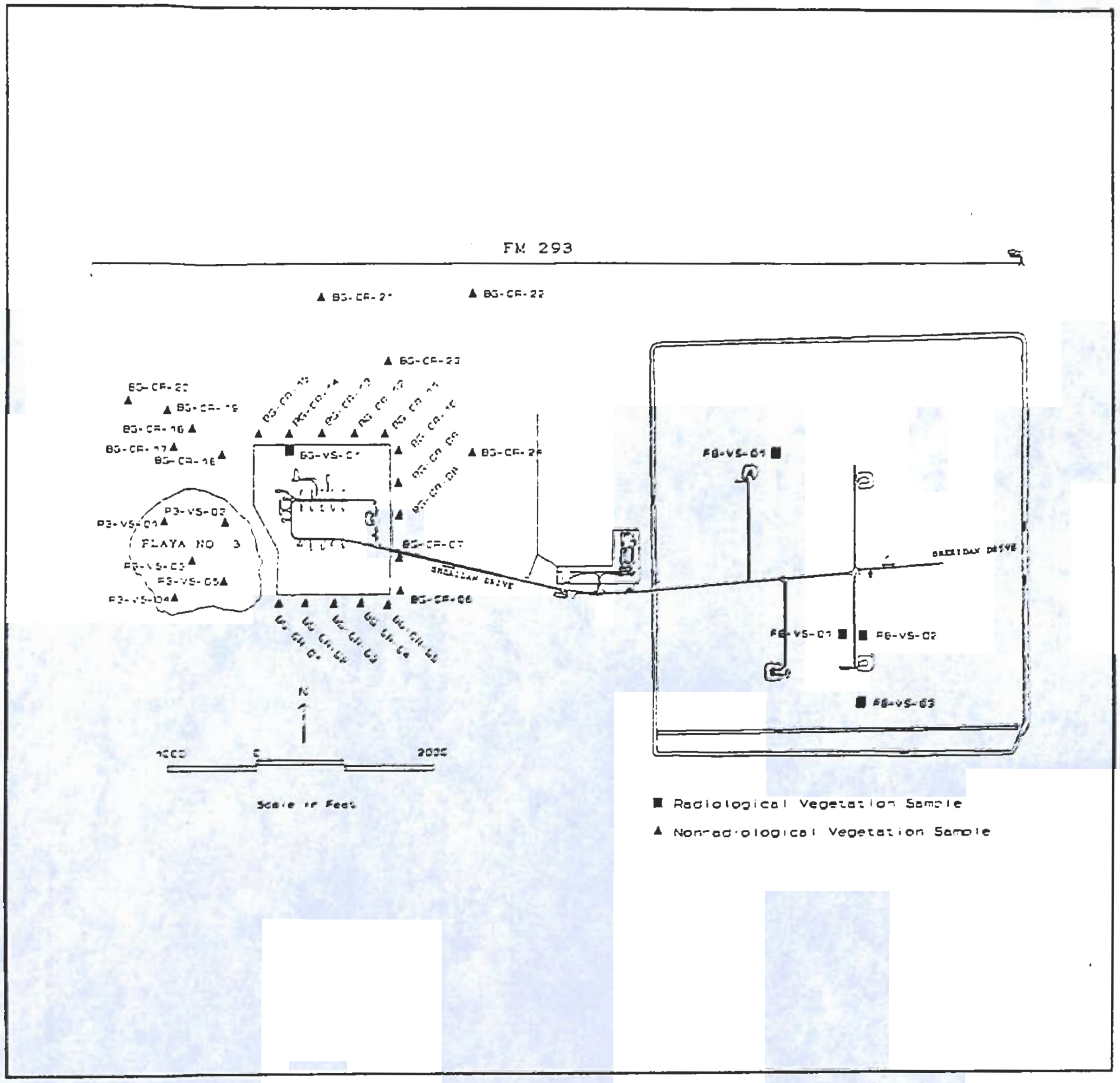

Figure 3.8 Onsite Vegetation Sampling Locations

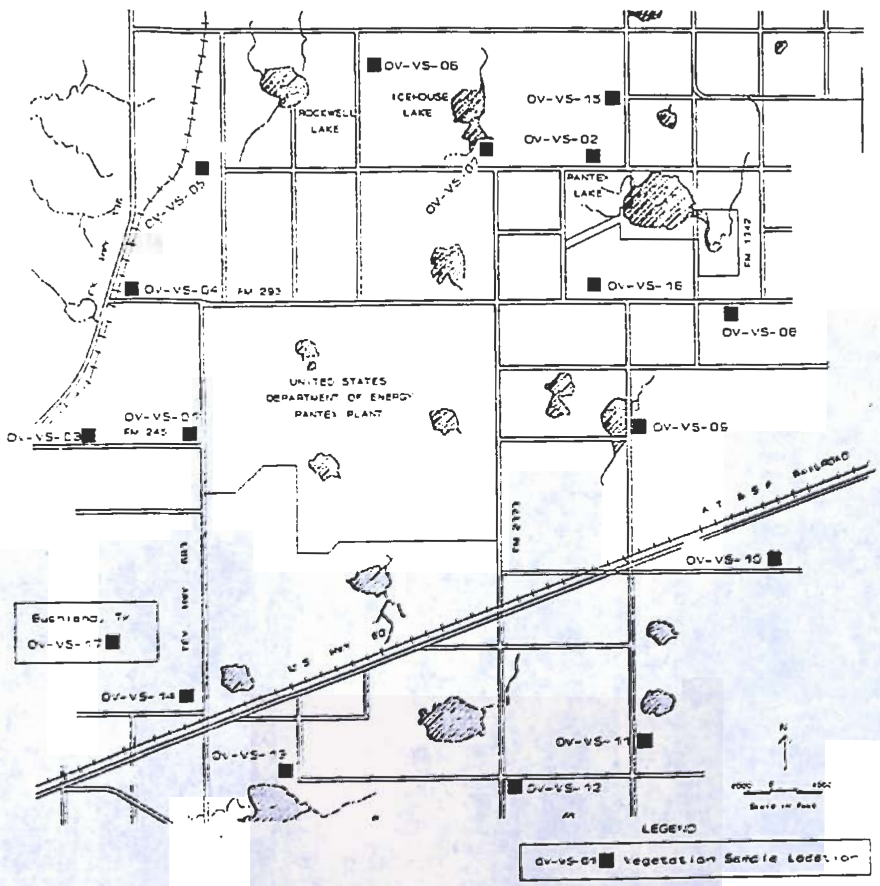

Figure 3.9 **Offsite Vegetation** Sampling Locations

Other offsite	Quarterly Annually	Uraniu[illegible] 238, Tritium Plutoni[illegible]
Crops		
Burning Ground	Quarterly Biannually	Uranium-234, U[illegible] Plutonium-239/240
Firing Sites	Quarterly Biannually	Uranium-234, Uranium-238, Tritium [illegible]40
		Analyses
Burning Ground (Flora)	Four times in late gr[illegible] season	
Bushland (Vegetation)	Quarterly	

ronmental samples will be obtained fro[illegible]
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3.4.1.2 Human Ingesti

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3.4.2 Non-Routine Sampling

3.4.2.1 Diagnostic Investigations

Occasionally sick, dying, or dead animals are analyzed using various tools (e.g., necropsy, toxicology, and histology). Such situations are unplanned and responses to them are spontaneous. Specific analyses vary on a case-by-case basis. Necropsies and any toxicological, histological, or other similar analyses are conducted by the Texas A&M Diagnostic Laboratory in Amarillo and/or by the U.S. Fish and Wildlife Service. Certain species are of special interest to the U.S. Fish and Wildlife Service and/or the Texas Parks and Wildlife Department. Information of interest to either group will be provided with concurrence by and through DOE.

3.4.2.2 Population Dynamics

Population dynamics of several species will provide information on the general environmental health of the Pantex Plant. Several studies projected for FY95 will undergo refinement as data are gathered and will provide the foundation for additional studies.

Many uninhabited World War II structures on the Plant now provide habitat for barn owls (*Tyto alba*). This bird of prey is of special interest to the U.S. Fish and Wildlife Service. Radiotelemetry techniques can be used to provide information on population densities, foraging stategies, and overall health of the barn owls and to suggest additional research issues.

The ferruginous hawk (*Buteo regalis*) is a candidate species under the federal Endangered Species Act. This species, whose nesting range includes the Llano Estacado, has only seven documented nesting records in Texas. No known breeders have been reported in Texas since 1967. The Pantex Plant has a substantial population of this raptor during winter. Radiotelemetry techniques may be used to obtain data on this species.

An ecological study of the swift fox (*Vulpes velox*) is planned for FY95. The positive determination of its presence at Pantex could initiate a series of focused assessment studies and protection measures for this species.

3.4.2.3 Systematic Surveys

Surveys for the presence/absence of various plant and animal groups will be conducted to provide additional data on species of concern and to increase understanding of the ecological systems on the Pantex Plant.

3.4.2.4 Prairie Dog Bioaccumulation Study

A limited study will be undertaken during FY95 to determine the biological fate of possible contaminants in prairie dogs. The prairie dogs will be live trapped during the winter months and their major organs will be analyzed for plutonium-239/240, uranium-234, uranium-238, pesticides, metals, and high explosives. The results of this study will determine if future sampling is required.

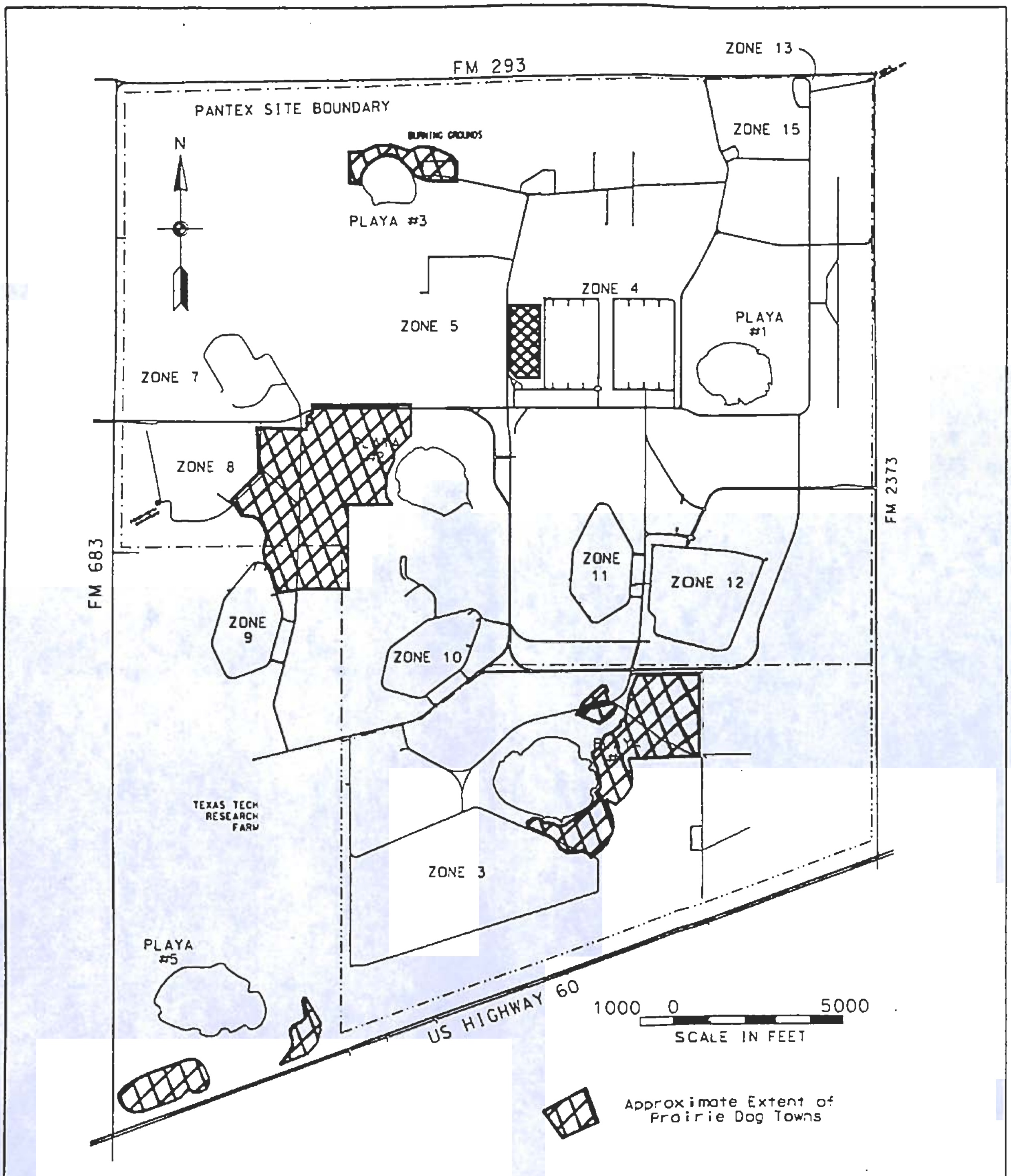

Figure 3.10 Approximate Locations of Prairie Dog Towns at Pantex

3.5 GROUNDWATER MONITORING

The geohydrology of Pantex Plant site has been described elsewhere (Purtymun and Becker 1982; U.S. Army Corps of Engineers 1992; Mason & Hanger 1993; Bureau of Economic Geology, various dates). Groundwater protection activities at the Pantex Plant are currently divided into three parts. Hydrogeologic characterization studies are being conducted by University of Texas at Austin Bureau of Economic Geology (TBEG) through a Grant in Aid from DOE. Groundwater remediation is conducted by the U.S. Army Corps of Engineers according to the provisions of the RCRA permit issued by the TNRCC. (The remediation administrative procedure will change now that the Pantex Plant is governed by CERCLA.) Routine groundwater sampling is conducted by the Environmental Protection Department. This plan addresses the routine and site-specific groundwater monitoring program outlined in the "Groundwater Protection Management Program Plan" (GPMPP) (Mason & Hanger 1993).

Procedures for the collection of groundwater samples and other data are given in a series of IOPs:

IOP D-4210, "Groundwater Sampling"
IOP D-4212, "Well Installation and Completion"
IOP D-4213, "Well Development"
IOP D-4214, "Pump Tests"
IOP D-4215, "Statistical Review of Indicator Parameters"
IOP D-4218, "Well Pump Extraction (Dedicated Bennett)."

3.5.1 Groundwater Sampling Locations

The current locations for routine groundwater sampling are established in the GPMPP. Chapter 5 of the GPMPP describes how the sampling program is designed to maximize the information that can be obtained from the use of existing wells. Additional wells will be added as needed to accommodate specific requirements.

Routine groundwater monitoring samples are collected from

- Six Ogallala aquifer monitoring wells
- Six perched groundwater monitoring wells
- Five Ogallala aquifer production wells
- One offsite water supply location at the USDA-ARS Bushland Station
- Four RCRA closure site perched groundwater monitoring wells.

Samples are also collected from

- offsite locations as requested or directed
- other onsite locations as requested or directed.

The U.S. Army Corps of Engineers currently samples wells constructed in support of the RCRA Facility Investigation (RFI) program. The results of the analysis are reported in separate site-specific reports as required by that program.

The routine monitoring locations are listed in Table 3.9 and illustrated in Figure 3.11. The RFI wells are listed in Table 3.10 and illustrated in Figure 3.12. More sampling locations may be added as a result of new permit requirements or additional RFI requirements.

The depth to the static water table varies by location. The depth to the perched groundwater ranges from approximately 200 feet to 300 feet. Well completion depths for perched monitoring wells range from 235 feet to 325 feet. The depth to the Ogallala aquifer, as measured in Ogallala monitoring wells, ranges from 400 feet to 470 feet. The total depths are approximately 700 feet.

3.5.2 Groundwater Sampling Equipment

All routine monitoring wells are currently equipped with dedicated Bennett sampling pumps. Dedicated Bennett pump systems are also used to sample the RFI program wells. A portable Bennett pump is used at locations without dedicated sampling systems. Bennett pumps were chosen as the best available pumps for two reasons:

- The pumps can achieve a reasonable pumping rate at the depths associated with the Ogallala aquifer (approximately 700 feet).
- The compressed air used to drive the pump does not come in contact with the groundwater sample, thereby reducing the possibility of purging volatile organic compounds from the sample.

Samples from the production wells are grab samples obtained from the normal pumped production at the wellhead. The sampling procedures specified in the EPA analytical procedure manuals are used when collecting samples for chemical analyses.

3.5.3 Groundwater Sampling Frequency

Water samples are currently collected monthly at the monitoring wells and the Bushland control location. Samples are collected every other month at the production wells. Water levels are measured monthly at the monitoring wells and semiannually at production wells. The RFI well water levels are measured monthly by the U.S. Army Corp of Engineers. Samples from the RFI wells are collected by U.S. Army Corp of Engineers quarterly. The Pantex Utilities Department measures water levels during 1-hour pump tests twice each year at the production wells.

3.5.4 Groundwater Sample Analyses

3.5.4.1 Radiological Analysis

Groundwater samples collected monthly are analyzed for the following radiological constituents at an offsite contract laboratory:

- Gross alpha/beta (dissolved)
- Gross alpha/beta (suspended solids)
- Tritium
- Radium-226 and radium-228 (quarterly)
- Uranium-234 and uranium-238
- Plutonium-239/240.

Table 3.9 Groundwater Monitoring Locations

Sample ID	Date Constructed	Location	Total Depth, feet
Ogallala monitoring wells			
OM-39	10-85	NW of Playa One	707
OM-40	10-85	SW of Playa One	684
OM-46*	08-89	N of Burning Ground	500
OM-47*	08-89	N of Burning Ground	500
OM-48*	09-89	N or Burning Ground	500
OM-105	04-92	Zone 10 Batch Plant	415
Perched zone monitoring wells			
PM-19	01-75	Playa One Test Well 1	350
PM-20	02-75	Zone 12 Test Well 2	350
PM-38	01-88	NE of Playa One	230
PM-44	07-88	UST Test Well NW of Zone 11	298
PM-45	07-88	UST Test Well Zone 12 N	275
PM-101	04-92	11-14 Pond	291
PM-102	04-92	11-14 Pond	294
PM-103	04-92	11-14 Pond	288
PM-104	04-92	11-14 Pond	288
PM-106	03-92	NE Plant Corner	282
Industrial/water supply wells			
PR-02	03-70	Production Well 15-17	847
PR-06	1942	Production Well 15-6	653
PR-16	11-70	Production Well 15-20	740
PR-18	06-66	Production Well 15-16	727
PR-41	10-85	Production Well 15-26	763
Offsite water supplies			
CO-33	--	Bushland Drinking Water	--

* Sampled by U.S. Army Corps of Engineers.

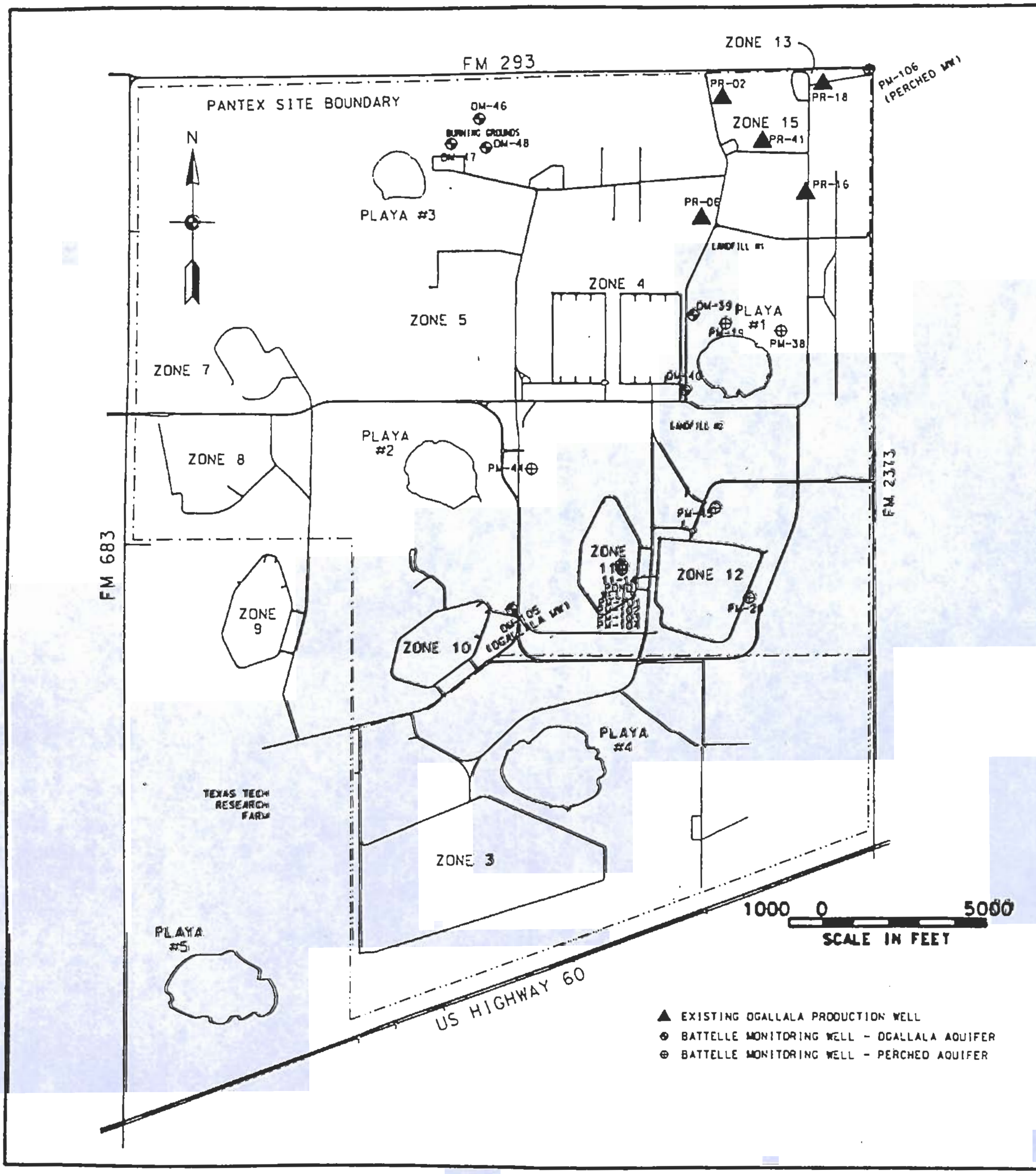

Figure 3.11 Onsite Groundwater Sampling Locations

Table 3.10 RFI Program Groundwater Monitoring Locations

Project Name/Well Number	Completion Date	Location (SWMU/BLDG)	Well Depth, feet
DITCHES & PLAYAS			
PTX08-1001	11-92	SWMU 6	230.5
PTX08-1002	12-92	SWMU 6	229.5
PTX08-1003	10-92	SWMU 5/AREA 11	300
PTX08-1004	12-92	SWMU 5/AREA 11	335
PTX08-1005	10-92	SWMU 5/AREA 11	288
PTX08-1006	10-92	SWMU 5/AREA 11	305.4
PTX08-1007	01-93	SWMU 5/AREA 12	293
PTX08-1008	01-93	SWMU 5/AREA 12	293
PTX08-1009	02-93	SWMU 5/AREA 12	290
PTX08-1010	09-92	SWMU 5/AREA 10	239
PTX08-1011A	09-92	BACKGROUND	441.5
LEAKING UST'S			
PTX10-1007	05-92	BLDG. 16-1	289
PTX10-1008	06-92	BLDG. 16-1	295
PTX10-1013	07-92	BLDG. 12-35	275
PTX10-1014	07-92	BLDG. 12-35	278
ZONE 12 GRDWTR			
PTX06-1001A	11-92	AREA #2	264
PTX06-1002A	01-93	AREA #2	273
PTX06-1003	10-92	AREA #1	263
PTX06-1004	01-93	AREA #2	286
PTX06-1005	01-93	AREA #2	294
PTX06-1006	12-92	AREA #2	293
PTX06-1007	01-93	AREA #1	292
PTX06-1008	12-92	AREA #1	278
PTX06-1009	11-92	AREA #1	265
PTX06-1010	10-92	AREA #1	279

			2XX
			X
			X
	94	S	X
	94	S , Landfill #1	2XX
	94	SWMU 688, Landfill #1	2XX
PTX07-1013	94	SWMU 688, Landfill #1	2XX
URNING GROUNDS			
PTX01-1001	04-94	South side of Burial Ground	299
PTX01-1002	04-94	SW of Playa Three	27
PTX01-1003	04-94	NW of Burial	48

3.5.4.2 Hazardous Chemical

No specific sampling and analysis requirements are given in the RCR
permit. Groundwater samples are therefore analyzed according to th
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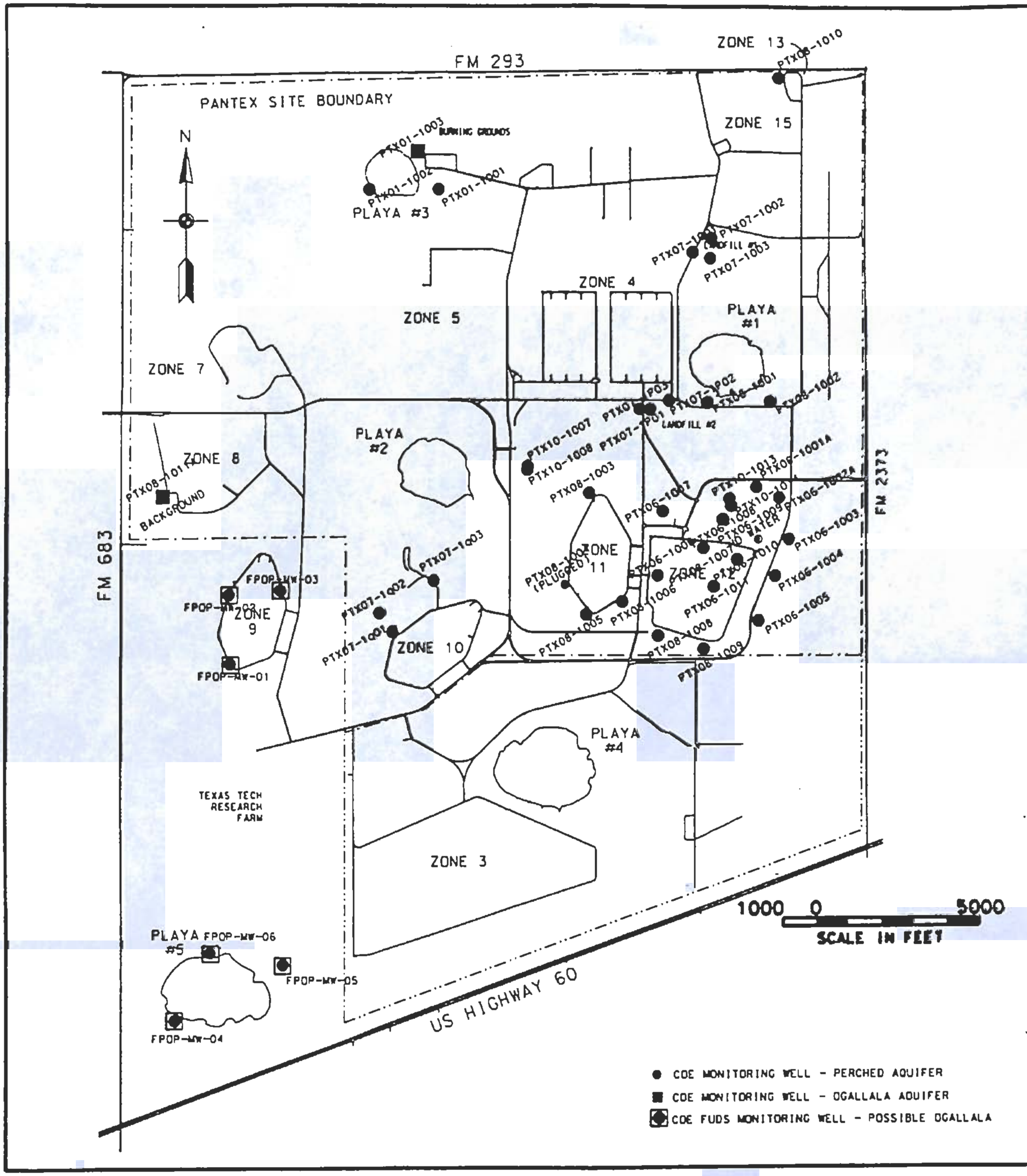

Figure 3.12 RFI Program Groundwater Sampling Locations

3.5.5 Data Review and Reporting

The data received from the analytical laboratories are reviewed for technical accuracy and compliance with the DQOs by the Sampling and Analysis Section. The data are published monthly and an analysis report is prepared. Any constituent found to exceed the detection limit of an analytical method is tabulated and compared to prior results. Control charts are prepared where applicable. Water levels are also measured and charted monthly. Summarized results are published in the Annual Site Environmental Report each year. Reviews of RCRA program data are reported separately according to program requirements.

3.5.6 Groundwater Sampling Changes and Special Projects Planned

The current Pantex Plant groundwater monitoring scheme will be evaluated and modified as necessary to assure coverage for all requirements and prevent unnecessary duplication with the TBEG Hydrogeologic Characterization Study.

Proposed and pending changes to the SDWA may affect the groundwater monitoring program. Under recent amandments to the Act, 83 contaminants have been identified and new regulatory limits have been established. This increase in the number of contaminants may increase the number of samples taken and the number of analyses that must be performed for each location.

Implementation of a comprehensive Integrated Environmental Database (IEDB) is currently under way. Analyses from previous years will be added to the database, as will current data. Analytical data will be accessible by sampling date, location, or type of analysis. The results of groundwater sampling by other programs, agencies, and activities will also be included in the IEDB. The database will be used to look for trends or sudden changes in the data. Methods employed will be those described by the EPA (EPA 1989). The use of the EPA-developed GRITS/STAT v 4.2 program for data analysis and tracking is being evaluated (EPA 1992).

At the same time as the Secretary of Energy's commitment regarding increased weapons components storage in the Zone 4 area, expanded environmental surveillance to respond to public concerns was proposed. It was proposed that, at the request of landowners and occupants, environmental samples will be obtained from residential water supplies immediately adjacent to the Pantex Plant boundary. Optimally, samples of domestic water would be collected periodically from each residence participating in the monitoring program. The environmental samples would then be analyzed by an offsite laboratory for potential contaminant species.

3.6 DRINKING WATER SAMPLING

The drinking water system at the Pantex Plant site consists of five water production wells, storage facilities, a treatment/chlorination facility, and the distribution system. The fire protection system uses the same water sources. Separate distribution facilities are provided for a high-pressure fire-fighting system. The drinking water system operates under the regulatory authority of the TNRCC (System Identification Number 0330007). The Pantex Plant Utilities Department conducts biological, chlorine residual, and some chemical and physical sampling. The Environmental Protection Department conducts physical, chemical, and radiological sampling.

Table 3.11 Constituents in the Groundwater Analytical Program

Volatiles

Acetone	Methylene chloride
Bromoform	Hexane
Benzene	N-Butyl alcohol
Dichlorobromomethane	4-Methyl-2-pentanone
Chlorodibromomethane	Di-isobutyl ketone
Chloroform	Chloromethane
Dimethylformamide	Bromomethane
Ethylbenzene	Vinyl chloride
Methyl ethyl ketone	Chloroethane
Methyl alcohol	Carbon disulfide
Tetrahydrofuran	1,1-Dichloroethene
Toluene	1,1-Dichloroethane
Xylene	trans-1,2-Dichloroethene
Isopropyl alcohol	1,1,1-Trichloroethane
Bromodichloromethane	Vinyl acetate
1,2-Dichloropropane	1,1,2,2-Tetrachloroethane
Trichloroethene	trans-1,3-Dichloropropane
cis-1,3-Dichloropropene	1,1,2-Trichloroethane
2-Hexanone	2-Chloroethyl vinyl ether
Chlorobenzene	Tetrachloroethene
1,4-Dichlorobenzene	Styrene

Semivolatiles

Bis(2-chloroethyl)ether	Benzyl alcohol
Bis(2-chloroisopropyl)ether	Hexachloroethane
Nitrobenzene	Isophorone
Bis(2-chloroethyoxy)methane	1,2,4-Trichlorobenzene
Naphthalene	4-Chloroaniline
Hexachlorobutadiene	2-Methylnaphthalene
Hexachlorocyclopentadiene	2-Chloronaphthalene
2-Nitroaniline	Dimethyl phthalate
Acenaphthylene	2,6-Dinitrotoluene
3-Nitroaniline	Acenaphthene
Dibenzofuran	2,4-Dinitrotoluene
Diethyl phthalate	4-Chlorophenyl phenyl ether
Fluorene	4-Nitroaniline
N-nitrosodiphenylamine	4-Bromophenyl phenyl ether
Bis(2-ethylhexyl)phthalate	Hexachlorobenzene
Phenanthrene	Anthracene
Di-m-butyl phthalate	Fluoranthene
Pyrene	Butyl benzyl phthalate
3,3-Dichlorobenzidine	Benzo(a)anthracene
Chrysene	Di-n-ocyrl phthalate
Benzo(b)fluoranthene	Benzo(k)fluoranthene
Indeno(1,2,3-cd)pyrene	Bibenzo(a,h)anthracene
Benzo(g,h,i)perylene	N-nitrosodi-n-propylamine
2-Methylphenol	4-Methylphenol
Benzoic acid	2,4,5-Trichlorophenol
4-Nitrophenol	2,4-Dimethylphenol
Phenol	2,4-Dichlorophenol
2,4-Dinitrophenol	2-Methyl-4,6-dinitrophenol
4-Chloro-3-methylphenol	Pentachlorophenol
2,4,6-Trichlorophenol	2-Nitrophenol
2-Chlorophenol	Benzo(a)pyrene

Table 3.11 (continued)

Pesticides and Herbicides		
	2,4,5-T	2,4-D
	Endrin	Lindane
	Toxaphene	Methoxychlor
	Heptachlor epoxide	Endosulfan sulfate
	Aldrin	alpha-BHC
	beta-BHC	delta-BHC
	Endosulfan II	4,4-DDT
	Chlordane	Dieldrin
	4,4-DDD	4,4-DDE
	Endrin aldehyde	Heptachlor
	Endosulfan I	
High Explosives		
	HMX	PETN
	RDX	TNT
PCB		
	Aroclor 1260	Aroclor 1254
	Aroclor 1221	Aroclor 1232
	Aroclor 1248	Aroclor 1016
	Aroclor 1242	
Metals		
	Arsenic	Lead
	Barium	Mercury
	Cadmium	Selenium
	Chromium	Silver
	Copper	Zinc
	Iron	
Radionuclides		
	Gross alpha, dissolved	Gross beta, dissolved
	Gross alpha, suspended	Gross beta, suspended
	Plutonium-239/240	Tritium
	Radium-228	Radium-226
	Uranium-238	Uranium-234
Miscellaneous		
	Cyanide	Fluoride
	Hardness	Nitrate (as N)
	pH	Phosphate
	Sulfate	Total dissolved solids
	Total suspended solids	Oil and grease

Procedures for the collection of drinking water samples and other data are given in the following IOPs:

IOP D-4210, "Groundwater Sampling"
IOP D-4215, "Statistical Review of Indicator Parameters."

3.6.1 Drinking Water Sampling Locations

The locations for routine drinking water sampling were established in the GPMPP. Additional sampling locations are added as needed to accommodate specific regulatory requirements.

Routine drinking water monitoring samples are collected from

- Four onsite drinking water locations
- Four biological sampling locations
- Twenty "lead & copper rule" drinking water locations.

The monitoring locations are listed in Table 3.12 and illustrated in Figure 3.13. The raw water from the five water production wells is sampled as part of the groundwater sampling program. The drinking water rules and regulations provide specific allowable contaminant levels. The observed concentrations from sample analysis are compared to the regulatory limits.

3.6.2 Drinking Water Sampling Equipment

All routine drinking water samples are grab samples. No special equipment is currently required. Onsite measurements of physical parameters are recorded in sampling logs. The sampling procedures specified in the EPA analytical procedure manuals are used when collecting samples.

3.6.3 Drinking Water Sampling Frequency

Chemical, radiological, and physical parameter samples are currently collected from the distribution system bimonthly. Biological samples are collected from the distribution system monthly. Samples are collected every other month at the production wells. Compliance sampling of the drinking water system is performed by the TNRCC. Samples are also collected as directed or requested by the TNRCC.

3.6.4 Drinking Water Sample Analyses

3.6.4.1 Radiological Analysis

Drinking water samples are analyzed for the following radiological constituents at an offsite laboratory:

- Gross alpha/beta (dissolved)
- Gross alpha/beta (suspended solids)
- Tritium
- Radium-226 and radium-228 (quarterly)
- Uranium-234 and uranium-238
- Plutonium-239/240
- Strontium-90.

3.6.4.2 Chemical and Physical Sample Analysis

The physical and chemical analysis requirements are specified in 40 CFR Parts 141, 142, and 143 and in 30 TAC Chapter 290. Table 3.13 lists the constituents to be identified in samples analyzed at an offsite laboratory. The Pantex Plant Utilities Department collects and analyzes samples as part of the operation of the treatment and distribution system.

3.6.4.3 Biological Analysis

One sample is collected from the production wells and four samples are collected from the drinking water distribution system monthly. The samples are collected by the Pantex Plant Utilities Department. The samples are tested at an offsite laboratory for total coliform group, fecal coliform group, and *Escherichia coli*.

3.6.5 Data Review and Reporting

Currently, when they are received from the commercial laboratory, all data are reviewed for technical accuracy and compliance with the DQOs by the Sampling and Analysis Section. The data are published monthly and an analysis report is prepared. Any constituent found to exceed the detection limit of an analytical method is tabulated and compared to prior results. Control charts are prepared where applicable. A summary of the results is published in the Annual Site Environmental Report.

3.6.6 Drinking Water Sampling Changes and Special Projects Planned

Changes in the SDWA may affect the drinking water monitoring program. Increases in the number of contaminants or in the frequency of sampling and lower contamination limits will tend to increase the number of samples taken and the number of analyses that must be performed at each location. Reporting requirements are also expected to increase. The necessary changes will be implemented and the monitoring plan modified as the regulatory changes are published.

Implementation of a comprehensive IEDB is currently under way. Sample results from previous years will be added to the database, as will current data. Analytical data will be accessible by sampling date, location, or type of analysis. The database will be used to look for trends or sudden changes in the data. Methods employed will be those described in EPA's "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Interim Final Guidance" (February 1989), 40 CFR 141, 40 CFR 143, or 30 TAC 290, as appropriate.

3.7 SURFACE WATER SAMPLING

No streams or rivers flow through or near Pantex Plant. However, sanitary wastewater treatment effluents, stormwater drainage, and occasional industrial effluents are discharged to ditches that discharge to playas. Playas also accumulate local surface water runoff. The industrial discharges from most of Zone 12 and the east side of Zone 11 are collected in Playa One. The discharges from the west side of Zone 11 are collected in Playa Two. Stormwater runoff from the Burning Ground discharges to Playa Three. The south ends of Zone 11 and Zone 12 discharge to Playa Four. Water loss from the playas is through solar evaporation and infiltration.

Table 3.12 Drinking Water Monitoring Locations

Sample ID	Location	Sample Types
DR-23	Building 12-2, IH Lab Sink	Chemical, physical, and radiological
DR-28	Building 12-6, Cafeteria Sink	
DR-43	Firing Site 1, Janitor's Sink	
DR-115	Building 15-27, Point of Entry	
DR-116	Building 12-103, Bathroom	Biological
DR-117	Building 18-1, Bathroom	
DR-118	Building 16-13, Lab Sink	
DR-119	Building 12-35, Bath	
1	Building 11-54, Janitor's Closet	Lead & Copper Rule; locations as listed in TNRCC records
2	Building 12-100, Women's Sink	
3	Building 12-101, Janitor's Closet	
4	Building 12-102, Men's Room	
5	Building 12-103, Men's Room (DR-119)	
6	Building 12-104, Break Room	
7	Building 12-106, Men's Room	
8	Building 12-107, Men's Room	
9	Building 12-110, Break Room	
10	Building 12-111, Janitor's Closet	
11	Building 12-112, Lab Faucet	
12	Building 12-113, Men's Room	
13	Building 12-121, Mechanical Room, Station 28	
14	Building 12-122, Men's Room	
15	Building 16-12, Cafe Sink	
16	Building 16-13, Janitor's Closet	
17	Building 16-19, Break Room	
18	Building 18-1, Killgore Lab Sink	
19	Texas Tech House	
20	Texas Tech Trailer House	

The surface water monitoring program consists of effluent monitoring and environmental surveillance activities (Mason & Hanger 1991). Effluent monitoring activities are described in Section 2.0 of this plan. Samples for surface water surveillance are collected in accordance with EPD IOP D-4185, "Surface Water Sampling Procedure."

3.7.1 Water Sampling Locations

Current surface water surveillance sampling locations are listed in Table 3.14 and shown in Figure 3.14. A discussion of permit requirements is provided at Section 2.1.2. The north ditch associated with

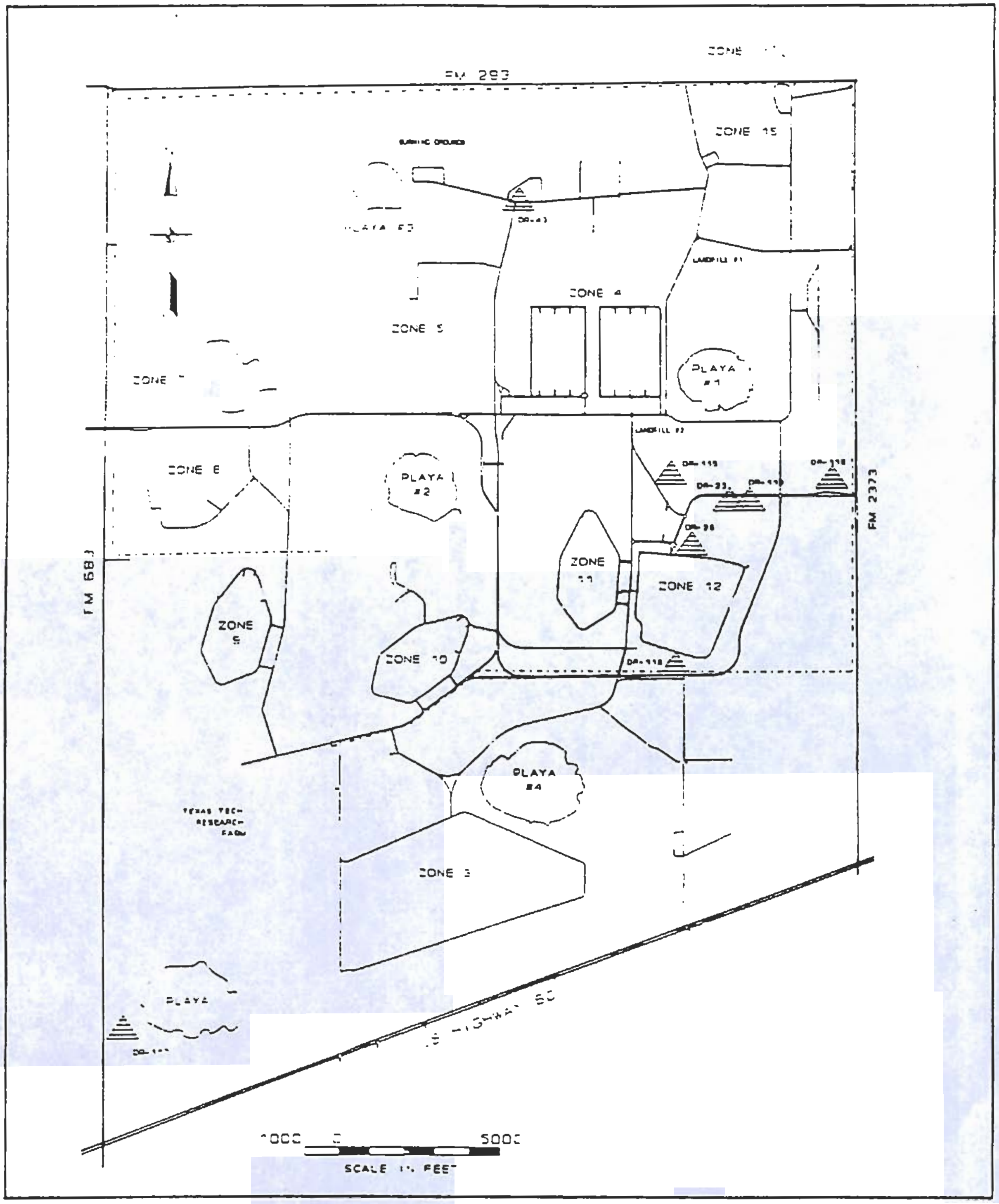

Figure 3.13 Drinking Water Sampling Locations

Playa Two is considered a reference location to assess general runoff, in that no ditches from facilities are connected to it. The majority of samples are grab samples. A few time-integrating samplers at various locations to obtain samples of stormwater runoff.

3.7.2 Water Sampling Frequency

Surface water samples for radiological analyses are collected monthly, as shown in Table 3.15. Water samples for nonradiological analyses are collected at various frequencies, as shown in Table 3.16.

3.7.3 Water Sample Analyses

Samples are analyzed by an offsite contract laboratory. The types of radiological analyses performed on surface water samples are summarized in Table 3.15. The types of nonradiological analyses performed on surface water samples are summarized in Table 3.16. Further details for nonradiological analyses are provided in PX-MNL-00045. Analytical methodologies are discussed in Section 6.

3.7.4 Data Review and Reporting

Data produced by an onsite laboratory or by offsite contract laboratories are delivered to the Sampling and Analysis Section for validation. The raw data and required QA results are examined thoroughly to determine if DQOs developed by the media manager are realized. Validated data are reviewed by the media manager according to IOP 16. Control charts and statistical procedures appropriate to the field are used to identify trends or shifts in the data (Section 7.3). Data are reviewed on a monthly basis, with a monthly interpretation report discussing nonradiological and radiological results that are reported as being above limits, and are submitted along with historical statistical limits. All results are published in the Annual Site Environmental Report. Unusual results, as defined by DOE Order 5000.3C, "Occurrence Reporting," and results that exceed permit or other regulatory requirements are reported immediately to the Pantex Operations Center. The Operations Center ensures that all other required reporting is done.

3.7.5 Surface Water Sampling Changes and Special Projects Planned

It is anticipated that changes to the sampling program will be required when new permits are issued, as discussed in Section 1. Additional analysis for selected herbicides and pesticides will begin in FY95. Special projects will be instituted as required by permit conditions or best management practices. Anticipated projects are

- Stormwater Characterization Study
- Biological and Chemical Study for the Wastewater Treatment Facility
- Alternatives to Discharge to Playas Study.

At the same time as the Secretary of Energy's commitments to increase weapons components storage in the Zone 4 area, expanded environmental surveillance to assess the potential impacts on the public and the environment was proposed. It was proposed that, at the request of landowners and occupants,

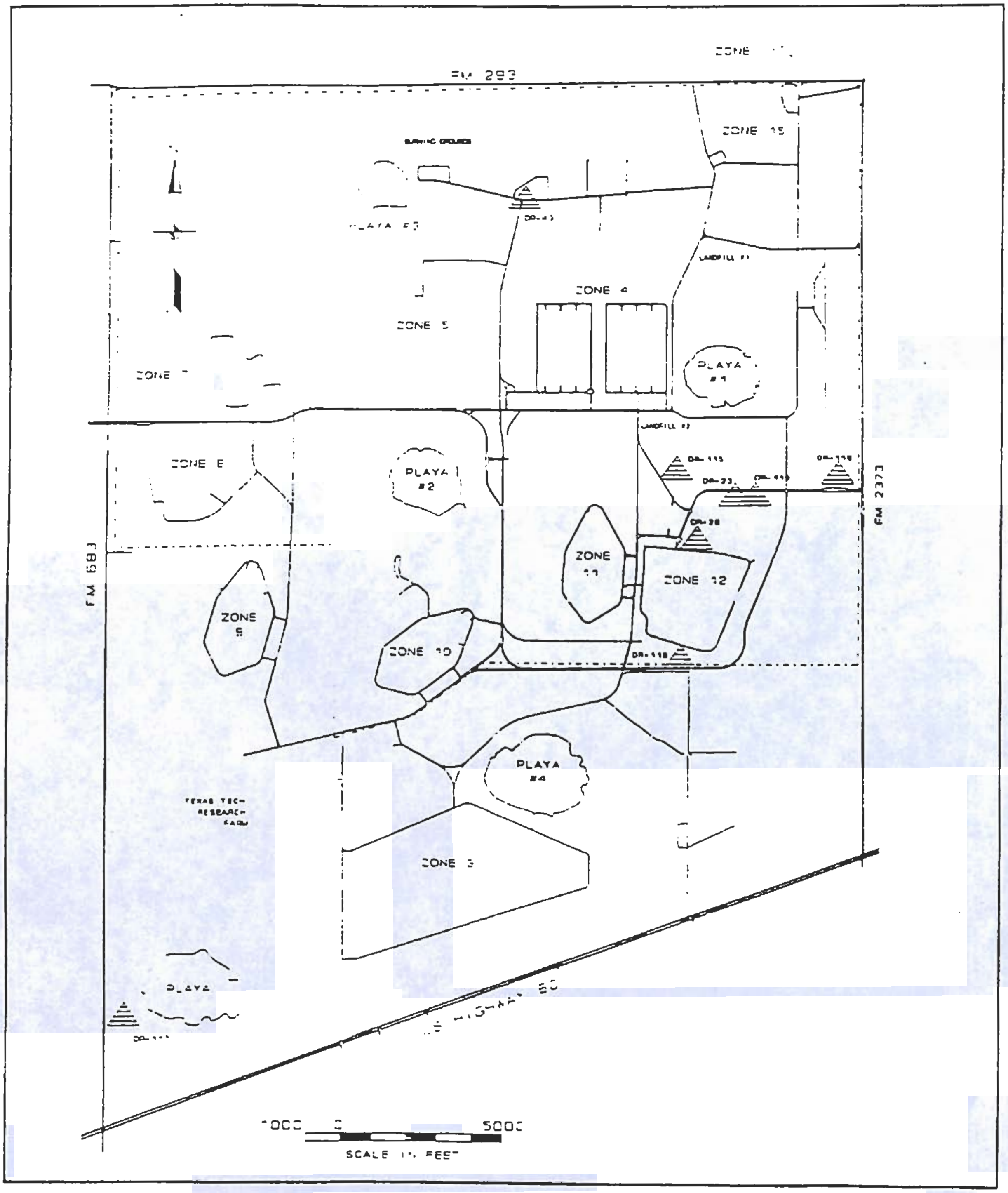

Figure 3.13 Drinking Water Sampling Locations

...ontract laboratory. ...
...ed in Table 3.15 ...
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...nalytical me... ...ection 6.

3.7.4 Data R... ...ing

Data produced... ...te laboratory or by offsite contract laboratories are delivered to th... and Analysis ... ...on. The raw data and required QA results are examined th... ...to determine if ... ...manager are realized. Validated data are revie... ...he ...anager according to IO... ...ol charts and statistical procedures appropriate ... ...ld ...to identify trends or shif... ...ved on a monthly basis, with ...y interpretation report ... ...l results that are reported as ...ove limits, and are subm... ...al Site Environmental R... ...g," and results that exce... ...x Operations Center. ...

...n face Water Sampling

Table 3.13 Constituents in the Drinking Water Analytical Program

Volatiles

- Benzene
- Bromoform
- Bromodichloromethane
- Bromomethane
- Dibromochloromethane
- Carbon tetrachloride
- Chlorobenzene
- Chloroethane
- Chloroform
- Chloromethane
- o-Chlorotoluene
- p-Chlorotoluene
- 2,2-Dichloropropane
- 1,1-Dichloroethane
- 1,1-Dichloroethene
- 1,2-Dichloroethane
- 1,2-Dichloroethene
- cis-1,2-Dichloroethene
- trans-1,2-Dichloroethene
- 1,3-Dichloropropane
- 1,3-Dichloropropene
- Ethylbenzene
- Methylene chloride
- 1,1,2,2-Tetrachloroethane
- 1,1,1,2-Tetrachloroethane
- 1,1,1-Trichloroethane
- 1,1,2-Trichloroethane
- 1,2,3-Trichloropropane
- Trichloroethene
- Tetrachloroethene
- Styrene
- Toluene
- Total xylenes
- Vinyl chloride

Semivolatiles

- 1,2-Dichlorobenzene (o-Di...)
- 1,4-Dichlorobenzene (p-Di...)
- Hexachlorobenzene
- 1,2,4-Trimethylbenzene
- Bromobenzene
- sec-Butylbenzene
- n-Butylbenzene
- Naphthalene
- Hexachlorocyclopentadiene
- Di(2-ethylhexyl)phthalate
- Di(2-ethylhexyl)adipate
- Fluorotrichloromethane
- p-Isopropyltoluene (4-Iso...)
- 1,3-Dichlorobenzene (m-Iso...)
- 1,2,3-Trichlorobenzene
- 1,2,4-Trichlorobenzene
- 1,3,5-Trimethylbenzene
- Bromochloromethane
- tert-Butylbenzene
- n-Propylbenzene
- Hexachlorobutadiene
- Benzo(a)pyrene
- Pentachlorophenol
- Dichlorodifluoromethane
- Isopropylbenzene

Pesticides

- Aldicarb
- Aldicarb sulfoxide
- Aldicarb sulfone
- Aldrin
- Carbaryl
- Carbofuran
- Chlorodane
- Dibromochloropropane (DBCP)
- Dieldrin
- Endrin
- Ethylene dibromide
- Heptachlor
- Heptachlor epoxide
- 3-Hydroxycarbofuran
- Lindane (as gamma-BHC)
- Methomyl
- Methoxychlor
- Oxamyl
- Toxaphene

Herbicides

- 2,4-D
- 2,4,5-T
- 2,3,7,8-TCDD - (Dioxin)
- Alachlor
- Atrazine
- Butachlor
- Dalaphon
- Dicamba
- Dinoseb
- Endothall
- Glyphosate
- Metachlor
- Metribuzin
- Pichloram
- Diquat
- Propachlor
- Simazine

Table 3.13 (continued)

PCB		
	Decachlorobiphenyl	
Metals		
	Aluminum	Lead
	Antimony	Manganese
	Arsenic	Mercury
	Barium	Nickel
	Beryllium	Selenium
	Cadmium	Silver
	Chromium	Sodium
	Copper	Thallium
	Iron	Zinc
Radionuclides		
	Gross alpha, dissolved	Gross beta, dissolved
	Gross alpha, suspended	Gross beta, suspended
	Plutonium-239/240	Tritium
	Radium-228	Radium-226
	Uranium-238	Uranium-234
	Strontium-90	
Miscellaneous		
	Alkalinity	Asbestos
	Calcium hardness	Chloride
	Color	Corrosivity
	Cyanide	Fluoride
	Foaming agents	Hydrogen sulfide
	Hardness	Nitrate (as N)
	Nitrite (as N)	Odor
	pH	Specific conductance
	Sulfate	Total dissolved solids
	Temperature	Total organic carbon

environmental samples be obtained from residences immediately adjacent to the Pantex Plant boundary. Optimally, samples of surface water would be collected periodically from each residence participating in the monitoring program. The environmental samples would then be analyzed by an offsite laboratory for potential contaminant species.

3.8 ENVIRONMENTAL DOSIMETRY

Radiological measurements are made for each medium sampled, as described above. In addition, measurements of penetrating radiation are made with thermoluminescent dosimeters and pressurized ion chambers.

3.8.1 Thermoluminescent Dosimetry

Thermoluminescent dosimeter (TLD) surveillance locations coincide with the 17 onsite and offsite air sampler locations, as described in Section 3.1. These and six additional perimeter locations are shown in Figure 3.15 and listed in Table 3.17. The Texas Department of Health - Bureau of Radiation Control co-monitors at a number of these locations. The dosimeter in use is the Panasonic UD-802 Thermoluminescent Dosimeter, which replaced the Victoreen Model 2600-46 bulb dosimeter in 1992.

The TLD uses lithium borate and calcium sulfate crystals. A hard plastic card secures four separate elements adjacent to each filter; a hard plastic shell protects the card from the weather. Only one element is used in assessing environmental parameters. A lead filter selectively attenuates the various types of incident radiation. Incident ionizing radiation that strikes the dosimeters will create a change in the crystalline structure of the element so that the crystal contains more energy than it would in its normal state. In the analytical laboratory, a heat lamp anneals the TLD crystals and frees the energy, which emerges from the crystal element as light. A photomultiplier converts the light into an amplified electrical pulse, which directly corresponds to the amount of radiation to which the crystal was exposed.

After every quarter, Environmental Protection Department (EPD) staff exchange the Pantex Plant environmental dosimeters, and the Radiation Safety Department processes the TLDs using a UD-710 Panasonic Automatic Thermoluminescent Dosimeter Reader, providing the readings to EPD.

The EPD reviews the data by trending analysis to determine if the average of the measured doses is statistically within an acceptable range from the average of historical values. Data and results are then reported in the Annual Site Environmental Report.

3.8.2 External Gamma Radiation Exposure Rate Monitoring

At the same time as the Finding of No Significant Impact for Interim Storage of Plutonium (DOE 1994), the Secretary of Energy made commitments to deploy better radiation detection equipment. In response to these commitments, the Pantex Plant is assessing the feasibility of deploying gamma radiation detection instruments. The locations of five proposed stations are shown in Figure 3.16. Four stations would be located near the middle of the four perimeter fences around Zone 4 West and would serve as perimeter monitors. The fifth would lie in the center of Zone 4 West and would serve as zone internal monitor and an adjunct to the four perimeter monitors. The instrument being considered is a Reuter Stokes 1013 Gamma Radiation Monitor; wireless radiomodems link the monitor stations to a remote personal computer that collects the data. The automation will reduce costs and demonstrate conformance with ALARA requirements.

Several offsite locations are being considered for public displays. The Pantex Plant has contacted the exhibit coordinator at the Don Harrington Discovery Center in Amarillo and discussed the feasibility of an exhibit.

The Pantex Plant is also exploring the use of limited site aerial surveys (via helicopter) to develop a baseline for radiological conditions at the Plant. Additional methods (ground survey, truck-mounted) are also being assessed for Zones 4 and 12. The information obtained also supports emergency response needs.

3.9 NONROUTINE SAMPLING

Nonroutine samples are collected from soils, waters, and wastes as needed to evaluate the material tested or to determine if a spill or release has occurred. Requests are processed in accordance with IOP D4103, "Special Request Sampling," to ensure that adequate samples are collected from the correct location for the appropriate analysis in a manner that is as protective as practicable for the worker. Each request is handled on a case-by-case basis and is sampled by an environmental monitoring technician.

nt boundary

Playa Two	16-1 Weir* (Outfall 004)
	North Ditch (Outfall 005)
Playa Three	--
Playa Four	Zone 12 South* (Outfall 006)
	Zone 11 South--west ditch†
	Zone 11 South--east ditch
Pantex Lake	--
	--

†... is ditch.

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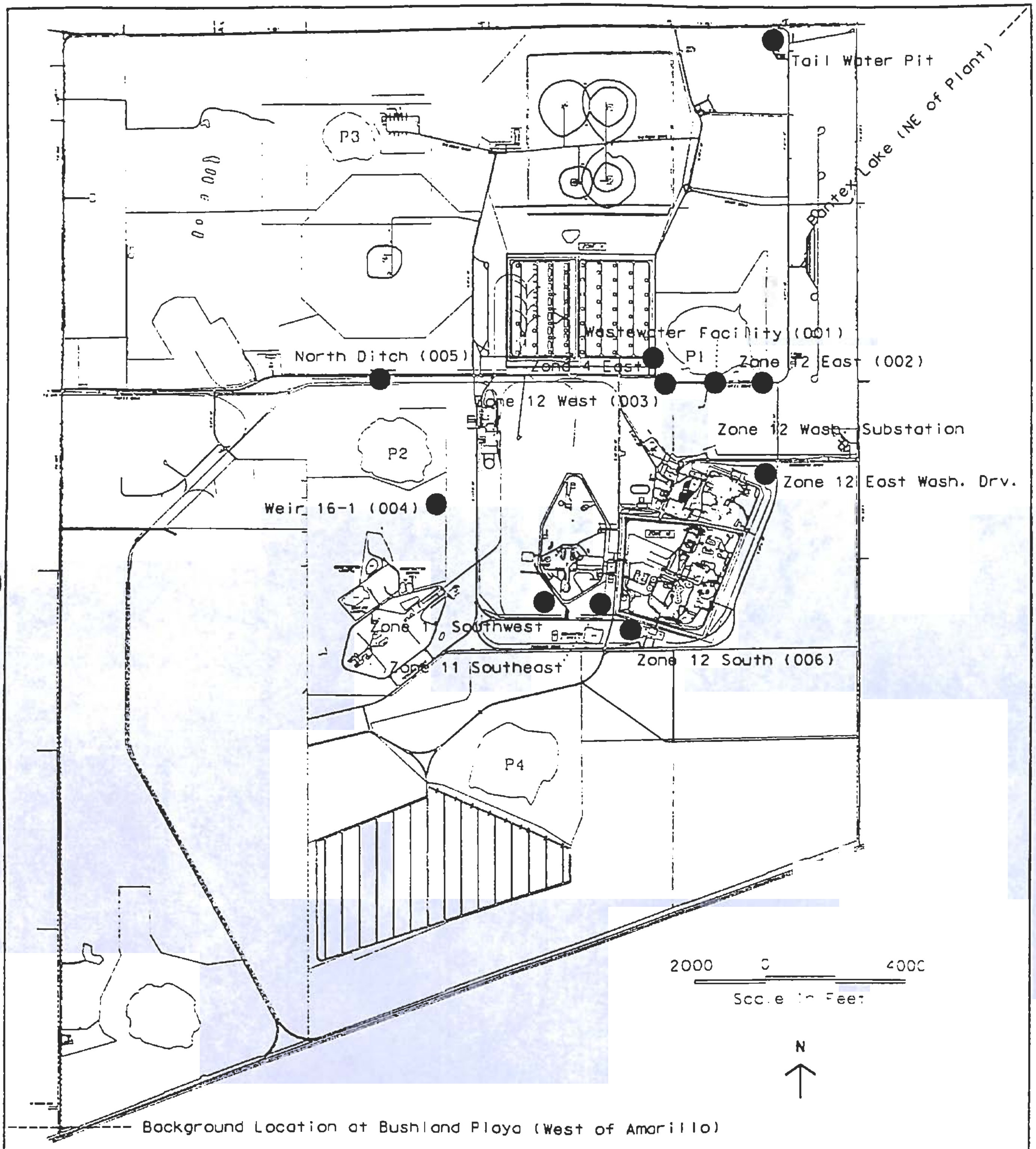

Figure 3.14 Plant-Wide Surface Water Sampling Locations

Table 3.15 Summary Schedule for Surface Water Radiological Sampling and Analysis

Locations	Water Source	Sampling Frequency	Analyses
Ditches to Playa One	Storm runoff and Zones 11 and 12 ditches	Monthly	Suspended and dissolved gross alpha/beta; uranium-234; uranium-238; plutonium-239/240; tritium; radium-226; radium-228
Ditches to Playa Two	Storm runoff and Zone 11 and Zone 16 ditches	Monthly	Suspended and dissolved gross alpha/beta; uranium-234; uranium-238; plutonium-239/240; tritium; radium-226; radium-228
Ditches to Playa Four	Storm runoff and Zone 11 and Zone 12 ditches	Monthly	Suspended and dissolved gross alpha/beta; uranium-234; uranium-238; plutonium-239/240; tritium; radium-226; radium-228
Playa One	Natural and effluents	Monthly when wet	Suspended and dissolved gross alpha/beta; uranium-234; uranium-238; plutonium-239/240; tritium; radium-226; radium-228
Playas Two & Four	Natural and effluents	Monthly when wet	Suspended and dissolved gross alpha/beta; uranium-234; uranium-238; plutonium-239/240; tritium; radium-226; radium-228
Pantex Lake	Natural	Monthly when wet	Suspended and dissolved gross alpha/beta; uranium-234; uranium-238; plutonium-239/240; tritium; radium-226; radium-228
Bushland Playa & Playa Three	Natural	Monthly when wet	Suspended and dissolved gross alpha/beta; uranium-234; uranium-238; plutonium-239/240; tritium; radium-226; radium-228

Mason & Hanger. 1991. **Surface Water Monitoring Program**. June 1991.

Mason & Hanger. 1993. **Groundwater Protection Management Program Plan**. May 1993.

Mason & Hanger. 1994. **Plan for Monitoring Airborne Radionuclide Emissions Other Than Radon from Pantex**. Draft. August 1994.

[redacted]

Table 3.16 Summary Schedule for Surface Water Nonradiological Sampling and Analysis

	Analyses*					
Locations	pH, Temperature	Chemical Oxygen Demand	Metals	Organics	Explosives	Misc.
Ditches to Playa One	D	SW	M	M	M	M
Ditches to Playa Two	D	SW	M	M	M	M
Ditches to Playa Four	D	SW	M	M	M	M
Playa One†	SW	SW	SW	SW	SW	SW
Other playas†	M	M	M	M	M	M
Pantex Lake	M	M	M	M	M	M
Bushland Playa	M	M	M	M	M	M

* D=Daily; SW=Semiweekly (twice per week); M=Monthly.
† When water is available for sampling.

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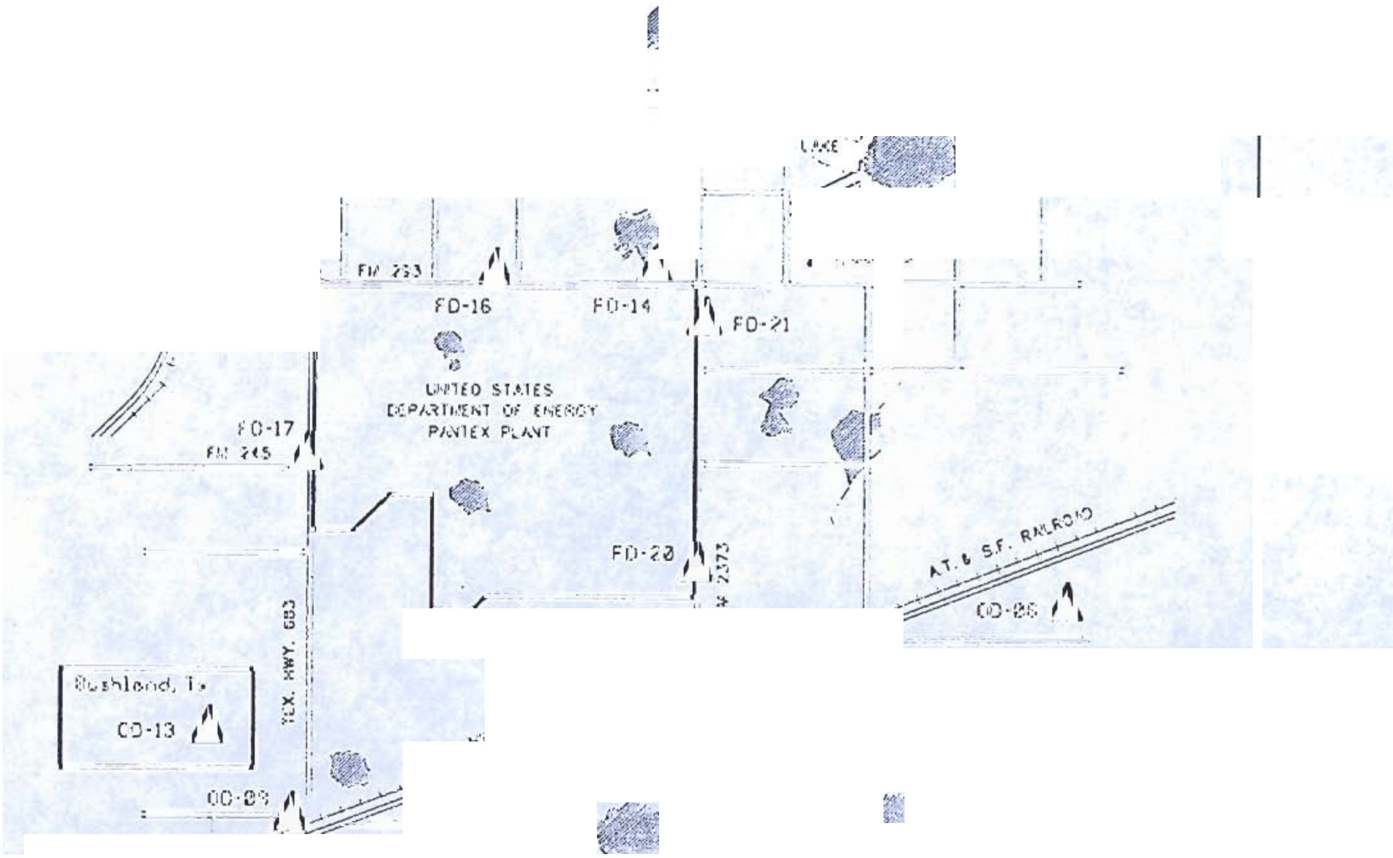
LAKE
FM 293
FD-16
FD-14
FD-21
UNITED STATES
DEPARTMENT OF ENERGY
PANTEX PLANT
FD-17
FM 245
FD-20
A.T. & S.F. RAILROAD
OD-06
Bushland, Tx
CD-13
TEX. HWY. 683
OD-03

Table 3.17 Thermoluminescent Dosimetry Monitoring Locations

Location ID	Description
Onsite	
PD-01	W of Water Well 17
PD-02	W of Old Water Treatment Building
PD-03	SW of Water Well 6
PD-04	Adjacent to N fence of E Side of Zone 4
PD-05	Adjacent to Pantex N fence on FM 293
PD-06*	E of Building 12-42
PD-07	NE of Building 4-26, W side of Zone 4
Offsite	
OD-01	2.0 miles N of intersection of FM 2373 and FM 293, 3.0 miles W, 0.2 mile N, 0.2 mile W
OD-02	2.0 miles N of intersection of FM 2373 and FM 293, 2.0 miles W, 1.3 miles N
OD-03	2.3 miles N of intersection of FM 2373 and FM 293
OD-04*	2.0 miles N of intersection of FM 2373 and FM 293, 2.0 miles E, 1.0 mile N, 0.3 mile W, SW corner
OD-05	1.5 miles E of intersection of FM 2373 and FM 293, 0.4 mile N
OD-06	4.1 miles E of intersection of FM 2373 and US 60, S fence line
OD-08	2.3 miles S of intersection of FM 2373 and US 60, SE corner of intersection at fence
OD-09*	Intersection of FM 683 and US 60, NW corner
OD-10	2.2 miles W of intersection of FM 683 and FM 245, N fence
OD-13	Bushland Station
Fence line	
FD-14*	0.6 mile W of intersection of FM 2373 and FM 293
FD-16*	2.1 miles W of intersection of FM 2373 and FM 293
FD-17*	Pantex West gate, barbed wire fence immediately S of large Plant sign
FD-19*	2.2 miles S of Pantex East gate on FM 2373, immediately N of railroad tracks
FD-20*	0.8 mile S of Pantex East gate on FM 2373
FD-21*	2 miles N of Pantex East gate on FM 2373

* Indicates a co-sampling location with Texas Department of Health-Bureau of Radiation Control.

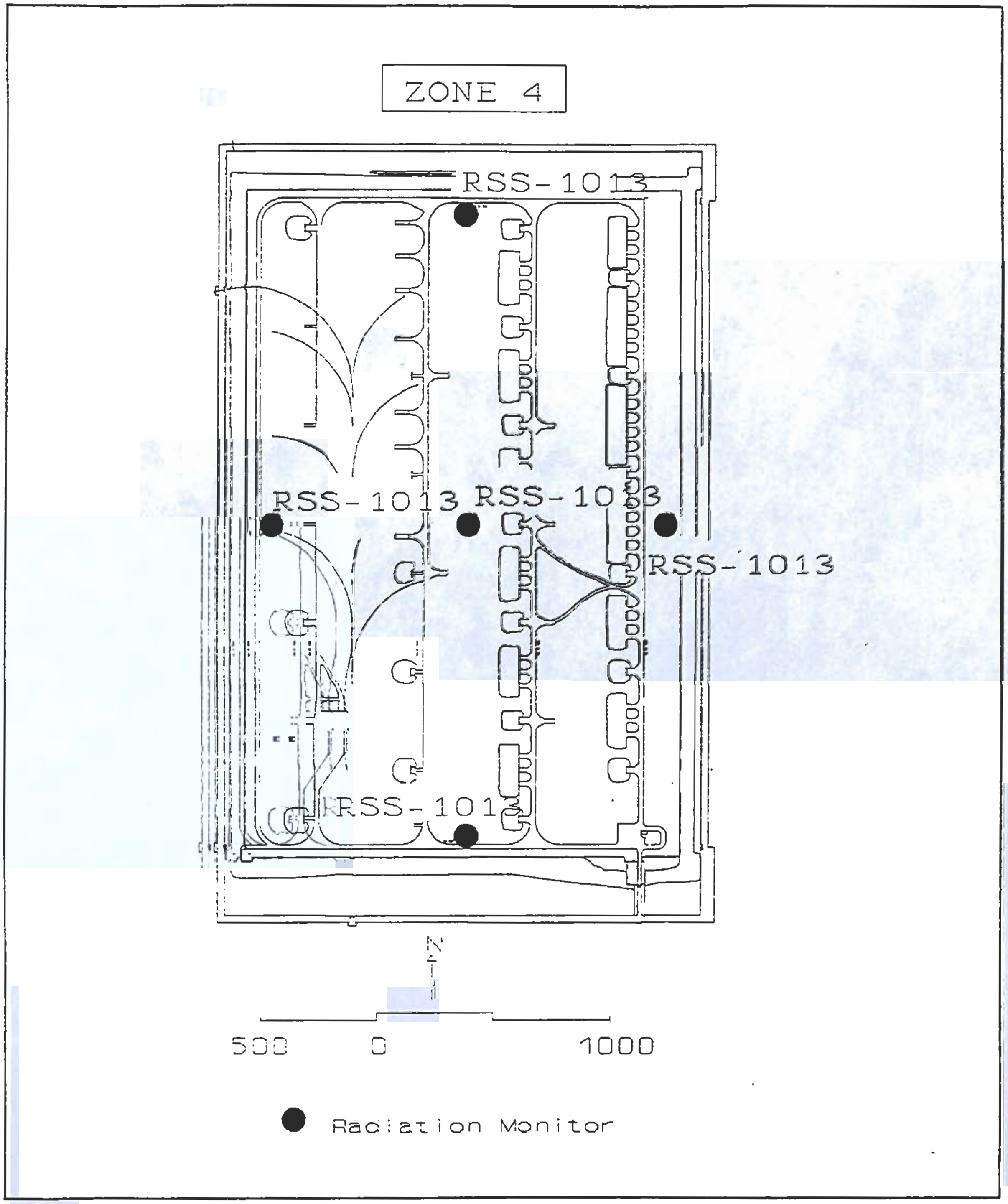

Figure 3.16 Proposed Locations of Zone 4 Radiation Monitors

4.0 METEOROLOGICAL MONITORING

U.S. Department of Energy (DOE) Order 5400.1, "General Environmental Protection Program," presents the requirements for meteorological monitoring programs at DOE facilities. Site meteorological monitoring facilities are intended to support impact assessments, environmental surveillance activities, and emergency response and dose assessment programs. The Environmental Protection Department is assigned responsibility for maintaining the program at the Pantex Plant.

4.1 METEOROLOGICAL MEASUREMENTS

The Pantex Plant maintains a meteorological monitoring station located on the northeast corner of the site. The monitoring station consists of a 60-meter tower located approximately 3700 meters north of the Zone 12 production area and was erected in the late 1970s (Snyder 1993a).

The tower is currently fitted with of sensors at the 10- and 60-meter elevations. Wind speed, wind direction, and temperature sensors are located at both levels. Relative humidity sensors were installed in 1986. In 1993, a barometric pressure sensor was added at the 3-meter elevation. A solar insolation pyranometer and a tipping bucket rain gauge are located at ground level southwest of the tower base. In 1992 a photovoltaic panel was added to provide an alternate electrical power supply, in addition to the 110-volt AC power/battery backup system.

In 1986 the station was added to the Atmospheric Release Advisory Capability (ARAC) program operated by Lawrence Livermore National Laboratory (LLNL), giving the Pantex Emergency Management Team access to the air diffusion/dose assessment capability of the ARAC system (LLNL 1992). Starting in 1986, meteorologic data were stored on floppy disks in the Professional Operating System (POS) of the Digital Equipment Corporation (DEC) format. Some of the more recent data have been transposed into the Disk Operating System (DOS) format for use in specific applications on IBM-compatible computer systems.

Sensor measurements are taken every 2-8 seconds, and these individual data points are condensed into 15-minute averages. The 15-minute averages, along with the maximum and minimum data points for each 15-minute interval, are stored in the memory of the tower data system. Every 15 minutes, the tower system downloads the meteorological data for the preceding 15-minute interval to a facility computer located in the Pantex Emergency Operations Center (EOC).

4.2 METEOROLOGICAL DATA PROCESSING

As mentioned above, a system has been installed to electronically transmit the tower meteorologic data to the EOC for storage on a DEC hard disk. Since 1992, computer programs have been written to transpose the POS meteorological data files into the ASCII format to prepare the STAR-formatted meteorological data for use in the CAP88 diffusion code required by the National Emission Standards for Hazardous Air Pollutants (NESHAP) other than radon from DOE facilities, as defined at 40 CFR 61, Subpart H, and to delimit the ASCII files for importing into Lotus 1-2-3®. The Lotus data files are used for preparation of annual wind roses.

4.3 METEOROLOGICAL DATA APPLICATIONS

Annual meteorological data are required for the assessment of radiological dose to the public from radiological releases at the Pantex Plant, as required by the U.S. Environmental Protection Agency's (EPA's) NESHAP regulation, promulgated under the federal Clean Air Act. In the past these calculations were performed using the EPA-approved codes AIRDOS-RADRISK and AIRDOS-PC.

Beginning in 1992, the EPA model CAP88, also authorized for use under NESHAP, was employed. National Oceanic and Atmospheric Administration (NOAA) meteorological data collected at the Amarillo International Airport, about 10 miles southwest of Pantex Plant, were employed in the air dispersion modeling. Use of these data was considered justified because the NOAA data collection site is close to Pantex Plant, the terrain around Pantex Plant and Amarillo International Airport is flat, the probability of airborne radionuclide releases from operations is low, and the predominant south to southwesterly winds tend to disperse plant releases away from highly populated areas (i.e., Amarillo). For the same reasons, a single meteorological tower was considered sufficient to adequately monitor meteorological conditions over the whole Plant area.

Beginning with the 1993 Annual Site Environmental Report and the 1993 NESHAP report, meteorological data collected from the Pantex meteorological tower were employed in wind dispersion calculations and other programs requiring meteorologic data. Use of Pantex-generated data rather than the NOAA data in wind dispersion calculations and other programs requiring meteorologic data was validated as follows: In June 1993, a comparison between National Weather Service data and Pantex-generated data was published (Snyder 1993b). The report compared acute and chronic doses received as results of hypothetical releases of tritium and plutonium-239. The report concluded that the hypothetical doses calculated using the two separate data sets in the dispersion codes were within the uncertainty expected from the use of current dose assessment codes, and therefore the two meteorological databases may be used interchangeably.

Plant meteorologic data are also employed in short-term (puff) and long-term (plume) air diffusion calculations for emergency response to accidental radiological releases to the atmosphere, through ARAC.

Other users of Pantex meteorologic data include the building freeze-protection program, which is designed to alert building managers and Utilities Department to the possibility of freezing pipes during winter months; high explosive burning operations, which are restricted to low wind-speed conditions; the Pantex Fire Department, which obtains wind direction and wind speed information before responding to alarms; the Texas Tech Research Farms, who use the data in crop-spraying operations; and Plant Security, who use the data to control Pistol Range and Rifle Range operations.

4.4 QUALITY ASSURANCE

Currently, semiannual calibrations of tower measurement devices are conducted by the National Interagency Fire Center (NIFC), Bureau of Land Management, U.S. Department of the Interior. The calibration includes replacement of wind speed, wind direction, and temperature/humidity sensors with sensors rebuilt and calibrated at the NIFC depot in Boise, Idaho. The barometric sensor is replaced annually. The rain gage is calibrated semiannually. Additionally instrument spans and telephone wire (MODEM) resistances are checked.

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5.0 QUALITY ASSURANCE

U.S. Department of Energy Order 5400.1 requires that a Quality Assurance (QA) program, consistent with the requirements of DOE Order 5700.6C, be established for each element of the Pantex environmental monitoring and surveillance program. The Pantex Plant as a whole complies with DOE Order 5700.6C by intrinsic inclusion of the requirements within the Plant hierarchy of documents that are strictly followed by all Plant personnel. The Pantex Plant also implements requirements codified at 10 CFR 830.120 for any non-reactor nuclear facility. Requirements for QA for the Environmental Monitoring Program are defined in a "Quality Assurance Manual for Environmental Monitoring" (PX-MNL-00044) and in other Internal Operating Procedures (IOPs). The Manual identifies controlling documents (DOE Orders); responsible organizations; and policies, standards, and procedures that implement the requirements of the controlling documents. Procedures for sampling various environmental media at Pantex are set forth in the Environmental Protection Department's (EPD's) IOPs.

The Sampling and Analysis Section of the EPD has primary responsibility for implementation of the QA program. This activity is supported by other Pantex Plant organizations, as shown in the Manual.

For the best QA, quality control (QC) must be present in all aspects of sampling and analysis. In addition, QC samples are run with each sample batch at the laboratory to assess the method of analysis and the proficiency of the technician. Because holding times are an important factor in the quality of the sample, these are controlled within applicable limits. To ensure the comparability of the analytical data with previous and future data, all samples are analyzed by U.S. Environmental Protection Agency- (EPA-) approved methods when available, including QA/QC procedures. Calibration procedures, including pre-calibration checks where appropriate, source checks, traceable standards, duplicate and blank samples, and other practices, are performed regularly in both field and laboratory situations. Finally, all sampling activities are designed to ensure that all data generated will meet the intentions of the driving requirements. The EPA Data Quality Objective (DQO) process (EPA 1987) has been adopted for all sampling activities.

5.1 QUALITY ASSURANCE IN THE FIELD

Pantex personnel routinely collect samples of various environmental media for analysis. Quality of all aspects of the field sampling procedures is checked by the use of field duplicates, decontamination rinsates, trip blanks, and field blanks. Duplicates are collected to check for consistent sampling. Decontamination rinsates are analyzed to check for cross-contamination from sampling equipment. Trip blanks are sent with each shipment that will be analyzed for volatile contaminants to check for volatile contamination from other samples during shipment. Field blanks are collected to check for contamination during the sampling process. Blanks, rinsates, and duplicates are submitted to the several laboratories conducting analyses at the same time as the field samples.

5.2 QUALITY ASSURANCE IN THE LABORATORY

A limited number of environmental sample analyses are done at the Pantex Plant. Most samples collected for radiological and chemical analysis are analyzed offsite by one of several offsite laboratories. In FY95 these laboratories and the analyses they accomplish are as follow:

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Pre-filters ... air samplers are screened by the Pantex Plant Radiation Safety Department ... ate samplers, using ... morning by the use of ... each morning as part of ... The samples are reviewed

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5.2.2 Contract Laboratories

Laboratory QA is analyzed externally by the blind submission of split samples, spiked samples, and blanks to the laboratories performing analysis for environmental samples. Spiked samples are submitted to the outside laboratories on a semiannual basis. Deionized water is sent as a blank occasionally to determine contamination resulting from laboratory procedures.

The QA program at all of the contract laboratories is summarized as follows:

Method QA is measured internally by the use of laboratory QC samples, which include blanks, duplicates, spikes, matrix spikes, surrogates, and standard reference materials. QC sample results are included in data reports received from the laboratory. In addition, controlling procedures and maintenance of results from standards by the contract laboratory is a portion of method QA.

Analysts, regardless of degree of experience, undergo a thorough, on-the-job training program. Each analyst observes an experienced chemist at work and studies the analytical procedures. Controlled copies of documents describing official analytical procedures are provided to each analyst. Once the technician is familiar with an analytical method, he or she is subjected to a procedure review to assure an understanding of and a proficiency in the running of the procedure. Comprehensive training records for each technician are maintained within the contract laboratory's QA program. Analytical results of all QC samples are reviewed and compared by Pantex staff upon receipt.

All reagents, carriers, and radioactive QC solutions that are in regular use and critical to proper results are standardized at least monthly or before use, as appropriate.

All instruments are maintained by the manufacturer through monthly preventive maintenance programs. Each instrument is calibrated weekly with sources traceable to the National Institute of Standards and Technology. If the calibration detects any anomaly from the routine performance of the instruments, no analysis is allowed to be performed on that instrument until it is functioning properly.

QA audits are periodically performed on each contractor by Pantex to evaluate adherence to the contractor's QA plan. Results of these audits are provided to the contractors. Any observation reports or corrective action reports must be reviewed and a response made by the contractor's QC officer.

Interlaboratory comparisons are conducted by Pantex by submitting spiked samples prepared by the DOE Environmental Measurements Laboratory (EML) for radionuclide analysis.

Laboratory QC samples include blanks, duplicates, spikes, surrogates, and standard reference materials. QC sample results are included in all data reports received from the laboratory. A documented IOP used by the contract laboratory follows EPA standards for laboratory QA. The IOP is used by laboratory personnel during all analyses. The following QC samples are analyzed by the contract laboratory:

Reagent Blank. The blank is an aliquot of deionized water that is treated as if it were a sample. The blank, where appropriate, should be subjected to a digestion, distillation, or any other pretreatment process required on the samples. The acceptance criteria for the blank are that it must be below the detection limit or, if the blank has a value, the only sample results that are acceptable must be more than 10 times the

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This information is used in obtaining outside contracts in selecting data validation criteria. The process allows for maintenance of a historical record of changes. Activities for FY95 include preparation of the DQOs by media managers, review by the Sampling and Analysis Section, and initiation of any identified changes.

5.4 REFERENCES

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U.S. Environmental Protection Agency (EPA). 1987. **Data Quality Objectives for Remedial Response Activities, Development Process**. EPA/540/C-87/003. March 1987.

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Table 6.1 Analytical Methods and Requirements for Nonradionuclide Analysis (Organics)

Analyte	EPA Method	Sample Volume Required	Container Type	Preservation (pH)	Sample Holding Time
Volatiles	8260	5 to 25 ml	Glass (with Teflon-lined lid)	Cool to 4 °C, HCl < 2	14 days
Semivolatiles	8270	1 L	Glass (with Teflon-lined lid)	Cool to 4 °C	7 days to extract, 40 days after extraction to analyze
Pesticides, PCBs	8080	1 L	Glass (with Teflon-lined lid)	Cool to 4 °C	As above
Herbicides	8150	1 L	Amber glass (with Teflon-lined lid)	Cool to 4 °C	As above
High Explosives	8330 (as modified)	5 ml	Glass	Cool to 4 °C	14 days
TOC (total organic carbon)	415.1 (ASTM D4129)	25 ml	Glass	Cool to 4 °C, H_2SO_4 or HCl < 2	28 days
TOX (total organic halogen)	450.1	250 ml	Glass	Cool to 4 °C, H_2SO_4 or HCl < 2	7 days
Oil and grease	413.2	1 L	Glass	Cool to 4 °C, H_2SO_4 or HCl < 2	28 days
Phenol	420.1	500 ml	Glass	Cool to 4 °C, H_2SO_4 < 2	28 days

TACB.1991. TACB Laboratory Methods Manual. Texas Air Control Board, Austin, Texas.

Table 6.2 Analytical Methods and Requirements for Nonradionuclide Analysis (Metals)

Analyte	EPA Method	Sample Volume Required	Container Type	Preservation (pH)	Sample Holding Time
Arsenic	206.2	200 ml	HDPE* or glass	$HNO_3 < 2$	6 months
Lead	239.2	200 ml	HDPE or glass	$HNO_3 < 2$	6 months
Mercury	245.1	100 ml	HDPE or glass	$HNO_3 < 2$	28 days
Selenium	270.2	100 ml	HDPE or glass	$HNO_3 < 2$	6 months
Hexavalent chromium	218.5	100 ml	HDPE or glass	Cool to 4 °C	24 hours
All other metals	6010 or 200.7	200 ml	HDPE	$HNO_3 < 2$	6 months

*HDPE is high-density polyethylene.

Table 6.3 Analytical Methods and Requirements for Nonradionuclide Analysis (Other Inorganics)

Analyte	EPA Method	Sample Volume Required	Container Type	Preservation (pH)	Sample Holding Time
TSS (total suspended solids)	160.1	100 ml	HDPE* or glass	Cool to 4 °C	7 days
TDS (total dissolved solids)	160.2	100 ml	HDPE or glass	Cool to 4 °C	7 days
Ammonia	350.3	500 ml	HDPE or glass	Cool to 4 °C, H_2SO_4 < 2	28 days
Nitrate/Nitrite	353.2	100 ml	HDPE or glass	Cool to 4 °C, H_2SO_4 < 2	28 days
Cyanide	335.3	500 ml	HDPE or glass	NaOH > 12	14 days
Sulfate	375.4	50 ml	HDPE or glass	Cool to 4 °C	28 days
Chloride	325.2	50 ml	HDPE or glass	Cool to 4 °C	28 days
Fluoride	340.2	300 ml	HDPE or glass	Cool to 4 °C	28 days
Total phosphate	365.2	50 ml	HDPE or glass	Cool to 4 °C, H_2SO_4 < 2	28 days
Orthophosphate	365.2	50 ml	HDPE	Cool to 4 °C	48 hours

*HDPE is high-density polyethylene.

exchange resin. The plutonium will then be eluted off the ion exchange column, coprecipitated with a neodymium salt, and microprecipitated onto micropore filters or directly onto planchets. A solid-state alpha spectrometer will be used to determine the activity of plutonium on the filters or planchets. Chemical recovery will be determined from the tracer peak. The adsorbed uranium salt on the ion exchange column from the above plutonium analysis will then be analyzed for uranium-234 and uranium-238. The uranium salt will be eluted off the column, and microprecipitated onto filters or planchets. A solid-state alpha spectrometer will be used to determine the activity of the indicated uranium isotopes on the filters or planchet. Chemical recovery will be determined from the tracer peak.

Analysis of tritium will be performed on water extracted from silica gel used in the low-volume air samplers. Moisture extracted from the air during sampling will be vacuum-distilled from the silica gel. Each column will contain about 200 grams of activated silica gel to act as a desiccant to remove water vapor from the air stream being sampled. Any tritiated water vapor present will be captured as water vapor and recovered for analysis. To obtain sufficient quantities of water vapor for analysis, the silica gel columns will be exchanged every other week. Used silica gel columns will be retained in a locked container after exchange and sent monthly to an offsite laboratory for analysis. A portion of the distillate will be mixed with a scintillation solution and counted in a liquid scintillation counter. The atmospheric tritiated water concentration will be determined by multiplying the tritium concentration of the distillate by a factor derived from the average absolute humidity for the period during which the sample was collected.

6.1.4 Analysis of Soil Samples for Radionuclides

The soil samples will be dissolved using a 40% hydrofluoric solution for the analysis of uranium-234, uranium-238, and plutonium-239/240. Uranium-232 and plutonium-236 tracers will be added. Nitric acid will be added to dissolve the resulting residue. The uranium and plutonium salts will then be adsorbed onto an ion exchange column, and the plutonium salt eluted off the column. The plutonium will be coprecipitated with a neodymium salt, and microprecipitated onto a filter. The filter will be counted for alpha activity on a solid-state alpha spectrometer. Chemical recovery will be determined from the tracer peak.

The effluent from the above plutonium analysis will be analyzed for uranium-234 and uranium-238. Uranium salts adsorbed on the ion exchange resin from the plutonium analysis will be eluted from the column, coprecipitated with a neodymium salt, and filtered from the solution. The filter will then be counted for alpha activity on a solid-state alpha spectrometer. Chemical recovery will be determined from the tracer peak. Tritium is analyzed for extracted water using a liquid scintillation method.

6.1.5 Analysis of Flora Samples for Radionuclides

Water will be extracted from the vegetation samples by freeze-drying distillation for tritium analysis. The distillation will be carried to dryness to ensure complete transfer of the tritium. A portion of the distillate will be mixed with scintillation cocktail and counted on a liquid scintillation spectrometer. Standard tritium and background samples will be prepared and counted at the same time as the "unknown" sample.

The dry vegetation will be ashed in a muffle furnace for the analysis of uranium-234 and uranium-238. A uranium-232 tracer will be added, and the samples digested to dryness with a strong acid and redissolved in hydrochloric acid. Nitric acid will be added to dissolve the resulting residue. The uranium salt will then be adsorbed onto an ion exchange column, and the adsorbed salt will be eluted from the column, coprecipitated with a neodymium salt, and filtered from the solution. The filter will then be counted for alpha activity on a solid-state alpha spectrometer. Chemical recovery will be determined from the tracer peak.

6.1.6 Analysis of Water Samples for Radionuclides

After thorough agitation of the water sample, a suitable aliquot will be taken for the analysis of gross alpha and beta. The aliquot will be acidified and evaporated to dryness on a hot plate, after which the residue will be dissolved in 1N (normal) nitric acid and transferred to a tared planchet. Gross alpha/beta activity will be determined by counting the planchet in an internal flow proportional counter. The result will be corrected for counter efficiency and self-absorption. A suitable aliquot of the water will be filtered through a Millipore 0.45-micron filter for the analysis of gross alpha and beta suspended solids. The filter will be counted by an internal flow proportional counter. Corrections will be applied for counter efficiency and self-absorption. After these two analyses are run, dissolved alpha and beta activities are determined by subtraction.

The total water sample will be aliquoted and acidified for the analysis of uranium-234, uranium-238, and plutonium-239/240. Uranium-232 and plutonium-236 tracers will be added to the aliquot, and the liquid evaporated to dryness. The residue will be ashed and dissolved in nitric acid. The resulting uranium and plutonium salts will then be adsorbed onto an ion exchange column and the plutonium salt eluted off the column. The plutonium will be coprecipitated with a neodymium salt and microprecipitated onto a micropore filter. The filter will be counted for alpha activity on a solid-state alpha spectrometer. Chemical recovery will be determined from the tracer peak.

Uranium-234 and uranium-238 salts adsorbed on the ion exchange resin from the plutonium analysis will be eluted from the column, coprecipitated with a neodymium salt, and filtered from the solution. The filter will then be counted for alpha activity on a solid-state alpha spectrometer. Chemical recovery will be determined from the tracer peak.

For the analysis of tritium in water, the water sample will be distilled to remove quenching materials and nonvolatile radioactive materials. Distillation will be carried to dryness to ensure complete transfer of the tritium to the distillate. A portion of the distillate will be mixed with scintillation solution and counted in a liquid scintillation counter. Standard tritium and background samples are prepared and counted at the same time as the sample.

6.2 SAMPLE HOLDING TIMES

Ensuring that sample holding times are met is an important part of the quality assurance plan for environmental monitoring activities. Sample holding times have been established by several national consensus standard organizations and codified by the EPA to provide reasonable assurance that, if the sample is analyzed within the specified period, the analyte being analyzed is still present at the same concentration as when the sample was taken. SW-846 (EPA 1986) is periodically reviewed to determine changes to applicable holding times. The sample holding times, along with preservation method and types of bottles that will be used in the monitoring program, are presented in Tables 6.1, 6.2, and 6.3. In

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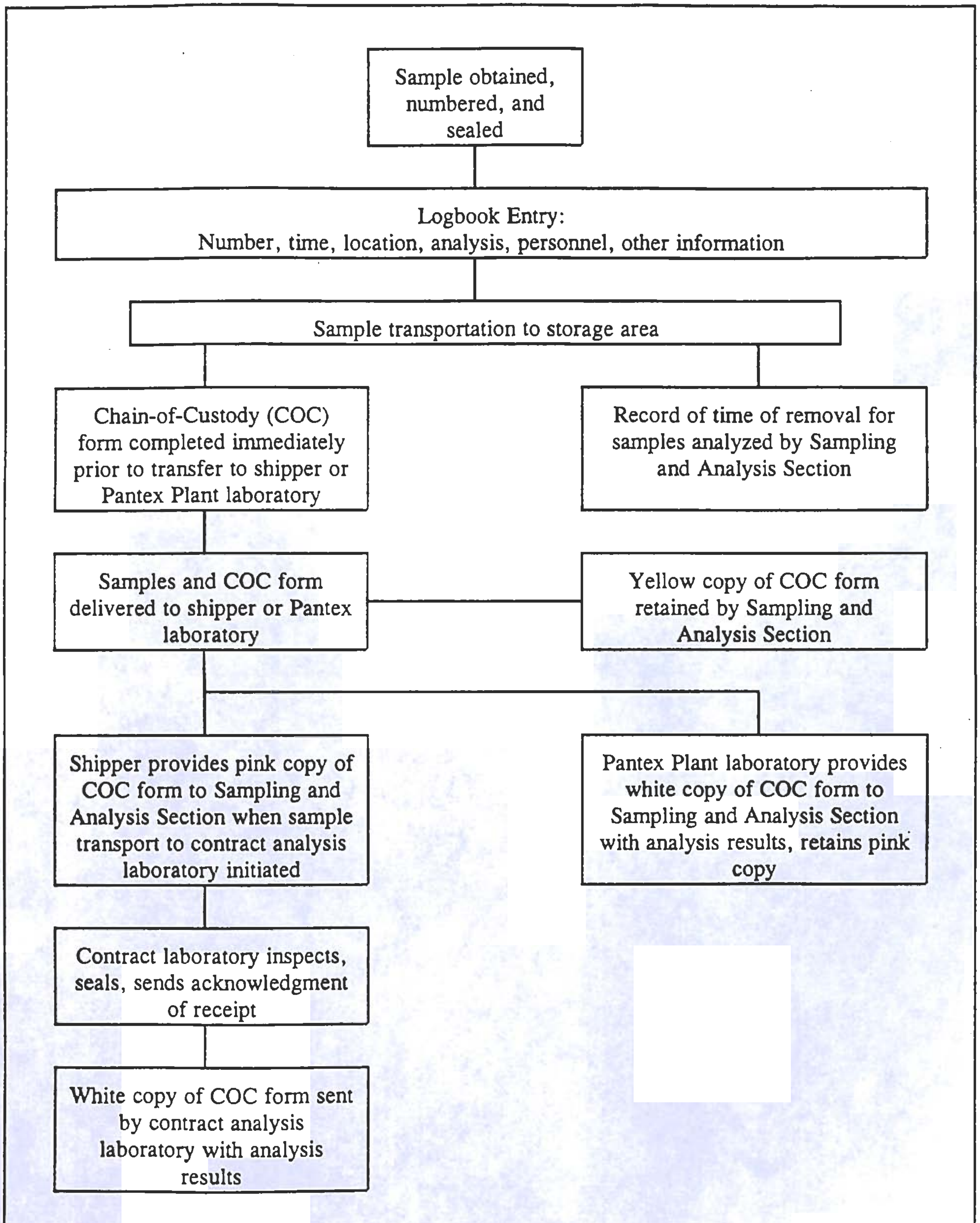

Figure 6.1 Chain-of-Custody Control Process

Jenkins, T. F. 1986. "Reversed-Phase High-Performance Liquid Chromotographic Determination of Nitroorganics in Munitions Wastewater." **Analytical Chemistry** 58:170-175.

U.S. Environmental Protection Agency (EPA). 1986. Test Methods for Evaluating Solid Waste. 3rd ed., Proposed Update II. SW846.3.2 (PB94-170321), Office of Solid Waste and Emergency Response, Washington, D.C.

7.0 DATA MANAGEMENT AND ANALYSIS

A step in obtaining data of known quality is tracking the status of the samples and results. After the data reports have been received, the information is validated against the predetermined data quality objectives in order to determine acceptance. When the results have been returned to the media manager, the data are evaluated against regulatory and/or permit requirements and historical data. A number of statistical analysis tools are then used to report the data. These topics are discussed below.

7.1 TRACKING DATABASE

A computerized database is used to keep track of all samples furnished by the Sampling and Analysis Section to the several analytical laboratories. Different modules of the database are used to track such parameters as the sample number, chain-of-custody number, sample type, location, analysis requested, laboratory sample number, the date that data are received, the date that data are validated, validators' initials, invoice number, and invoice amount. The sampling date and the date of analysis on the report are analyzed to determine if holding times were met. Invoices for the analysis are tracked to assure that the invoice charges match the analysis performed and that they are checked off as paid. After the data results have gone through the data validation process, the results are entered in the management database. Information more than one year old will be stored on Bernoulli disks.

The management database is linked to the tracking database by the sample number. The management database contains all sample numbers, sample results, laboratory Quality Assurance/Quality Control (QA/QC) results, and notations that qualify or disqualify any data. Electronic transfer of data from the analysis laboratories will be implemented in the future, streamlining data transfer and reducing the need for double entry and the potential for transcription errors. Data will be imported directly into the database. This enhancement is expected to be implemented during late FY95.

7.2 DATA VALIDATION

Level III data quality objectives are used for this plan, as defined in "Data Quality Objectives for Remedial Response Activities," Appendix B (EPA 1987). All QC results for the data (other than radionuclide data) are checked to determine if the results fall within specified limits. All external QC is also evaluated. Notations are made, to accompany data, expressing the validity and any qualifiers of the data. The person performing the quality validation initials and dates the validation report and returns the data report attached to the validation report.

7.3 STATISTICAL ANALYSIS

7.3.1 Reporting Frequency

Monthly reports are prepared as the data compilation reports are released. Statistical analysis is used to detect trends, changes, unusual occurrences, new contaminant detections, or other items of special interest. Internal Operating Procedure (IOP) 16 provides general guidance for monthly analysis procedures. The presence or absence of perceptible trends or shifts in the monitoring data, as established by the statistical control charts, is addressed in the monthly monitoring data interpretation reports.

An Annual Site Environmental Report is prepared according to the requirements of U.S. Department of Energy (DOE) Order 5400.1. The chapters are media-specific. Data analysis results are reported by medium and location sampled. The data are analyzed using the statistical procedures described below. The general procedure is for statistical analysis by analyte, by location, with comparisons of central tendency values, variance, regulatory limits, and control limits based on detection.

7.3.2 Statistical Procedures

Validated monitoring data are received by the media managers from the Sampling and Analysis Section. The monitoring data are compared, by location, to the historical central tendency value, historical variance, detection limits, regulatory limits published for each parameter, and statistical control limits. The differences between the monitoring programs dictate individualized statistical procedures for analysis of the respective monitoring data sets. Regulations in some cases require specific statistical methods or approaches to the analysis. Media managers determine what statistical limits to use for their individual programs.

Statistical control limits are used to characterize changes in monitoring data as statistically significant or not significant. The statistical control limits will be set at levels that define the extremes of historical variance. Locations where monitoring data fall outside the established limits are reported in the monthly interpretation reports. Monitoring data values that are within the established limits for the respective locations are considered expected values for that monitoring period.

Monitoring data (and if available, the previous 12 months of data) for locations that show monitoring data outside the established limits are graphed on statistical control charts. This process is used to aid in the definition of developing trends or shifts in the environmental data.

Apparent trends, as shown by statistical control charts, are characterized statistically. This characterization is accomplished with such statistical tools as regression analysis, the Cox and Stuart Test for Trend, or other accepted statistical methods appropriate to the media managers' professional fields. Guidance by regulatory authorities is used if available, e.g., guidance in "A Ground Water Information Tracking System with Statistical Analysis Capability" (EPA 1992).

7.3.3 Media-Specific Procedures

7.3.3.1 Air

At present radionuclides (uranium-234, uranium-238, plutonium-239/240, and tritium) are the only analytes monitored by the air monitoring program. The mean activity values are calculated and compared to the derived concentration guide values from DOE Order 5400.5.

7.3.3.2 Soil

Data from analysis of soil samples are compared to historical values, as required by DOE Order 5400.1. No standards exist for uranium-234, uranium-238, or plutonium-239/240 in the Pullman soil; therefore data are compared to the historical averages from the respective sites and the averages of samples taken at the

Bushland control location. Averages currently include historical routine monitoring data from 1988 through 1993.

To support the new hazardous waste permit for the High Explosive Burning Ground, analyses for high explosive residues, selected metals, and selected volatile organics were added to the Burning Ground surface soil sampling program during 1994. Standards for these analytes in common soils on the Pantex Plant were published by the Corp of Engineers in March 1994 ("Risk Reduction Rule Guidance to the Pantex Plant RFI"). Data was compared to the laboratory detection limits and the "clean" levels published by the Corps of Engineers.

7.3.3.3 Vegetation

Samples of native vegetation (grasses and forbs) and crops (grain sorghum and winter wheat) are analyzed for radionuclide (uranium-234, uranium-238, plutonium-239/240, tritium) and fluoride concentrations. The maximum, minimum, mean, and standard deviation of the observed results are calculated. The radionuclide values are compared to historical averages for the respective locations and the historical results from the Bushland control location. The fluoride concentrations are compared to the regulatory requirements in 30 TAC 113. No regulatory limits or standards exist for uranium, plutonium, or tritium concentrations in vegetation.

7.3.3.4 Groundwater

Data analysis is performed along the guidelines set by the U.S. Environmental Protection Agency (EPA) for Resource Conservation and Recovery Act (RCRA) -regulated facilities (EPA 1989). Standard deviation is calculated using sample standard deviations for small sample groups. In calculations with less than 15% "no detects," a value equal to half the detection limit is substituted for the "no detect." If the number of "no detects" is greater than 15%, but less than 50%, then Cohen's Method (EPA 1989) is used to adjust the mean and standard deviation. If the number of "no detects" is greater than 50% of the total samples taken or Cohen's Method is not applicable, then no mean or standard deviation is calculated. The maximum and minimum values are included in the annual reports regardless of the percentage of "no detects." The maximum and minimum values for groundwater contaminant indicators and groundwater quality parameters are currently tracked in the monthly reports.

7.3.3.5 Drinking Water

Specific guidance for statistical evaluation of compliance with the Maximum Contaminant Levels (MCLs), Maximum Contaminant Level Goals (MCLGs), and the Secondary Maximum Contaminant Levels (SMCLs) is published in 40 CFR 141, 40 CFR 143, and 30 TAC 290. Radionuclide values are also compared to derived concentration guide values from DOE Order 5400.5. The general approach is to calculate annual running averages and compare the result to the MCL, MCLG, or SMCL. The averages are reported in the annual reports. Individual values are checked in the monthly reports.

7.3.3.6 Surface Water

Surface water statistical values are compared to wastewater no-discharge permit limits (TNRCC Permit 02296) and to derived concentration guide values in DOE Order 5400.5 and 40 CFR 136.

Means are calculated by substituting the detection limit for those samples with values below the detection limit. This method over estimates the mean value and is recorded as a "less than" calculated mean.

7.4 DOSE CALCULATIONS

NESHAP requires that the exposure level to offsite individuals at DOE sites be determined by using certain EPA-approved atmospheric diffusion codes. The Pantex Plant currently uses the EPA-approved CAP88-PC code for the calculation of the dose to maximally exposed offsite individuals. Default meteorology data is from the Pantex meteorological tower. Procedures for performing calculations are listed in Environmental Dose Calculation Manual (PX-MNL-50) (PNL 1994).

7.5 REFERENCES

Pacific Northwest Laboratory (PNL), 1994. **Pantex Plant Environmental Dose Calculation Manual.** (PX-MNL-50) February 1994.

U.S. Environmental Protection Agency (EPA). 1987. **Data Quality Objectives for Remedial Response Activities, Development Process**. EPA/540/C-87/003. March 1987.

U.S. Environmental Protection Agency (EPA). 1989. **Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities - Interim Final Guidance.** PB89-151047. February 1989.

U.S. Environmental Protection Agency (EPA). 1992. **A Ground Water Information Tracking System with Statistical Analysis Capability - GRITS/STAT v4.2.** EPA/625/11-91/002. November 1992.

APPENDIX A

Status of Internal Operating Procedures

ENVIRONMENTAL PROTECTION DEPARTMENT INTERNAL OPERATING PROCEDURES

Number	Name	Issue	Date
D4101	GENERAL SAMPLING PROCEDURES	C	02-14-94
D4102	SAMPLING AND ANALYSIS SECTION - HEALTH & SAFETY PLAN	C	02-14-94
D4103	SPECIAL REQUEST SAMPLING	C	02-14-94
D4108	WASTE DISPOSAL PROCEDURES	C	02-14-94
D4131	QUALITY CONTROL SAMPLES	B	02-14-94
D4133	SPIKED SAMPLES PROGRAM	C	02-14-94
D4134	DATABASE MAINTENANCE	*	*
D4135	DATA VALIDATION	*	*
D4150	AIR SAMPLING PROCEDURE	C	02-14-94
D4185	SURFACE WATER SAMPLING PROCEDURE	C	02-14-94
D4210	GROUNDWATER SAMPLING	C	02-14-94
D4218	WELL PUMP EXTRACTION (DEDICATED BENNETT)	C	02-14-94
D4235	SOIL SAMPLING PROCEDURES	B	02-14-94
D4260	VEGETATION SAMPLING PROCEDURES	B	02-14-94
D4261	INORGANIC FLUORIDE IN VEGETATION	A	02-14-94
D4262	BIOTA SAMPLING PROCEDURE	C	02-14-94
D0001	SCREENING OF LOW VALUE AIR PRE-FILTERS FOR GROSS ALPHA/BETA ACTIVITY	2	08-30-91
IOP 16	ENVIRONMENTAL MONITORING DATA TRENDING PROCEDURES	1	04-21-94
IOP 188	INSTALLATION AND USE OF SOIL SOLUTION SAMPLES	*	*
D-4212	WELL INSTALLATION	*	*
D-4213	WELL DEVELOPMENT	*	*
D-4214	PUMP TESTS	*	*
D-4215	STATISTICAL REVIEW OF INDICATOR PARAMETERS	*	*

* Currently being prepared

APPENDIX B

Facility and Point of Discharge Descriptions

FACILITY AND POINT OF DISCHARGE DESCRIPTIONS

The following is a discussion of building operations and the potential contaminants that could be released to the environment by routine activities. Information in regard to potential release of radionuclides to air can be found in the report "Building-by-Building Analysis of Potential Radionuclide Emissions from Pantex" (Mason & Hanger 1992).

Liquid discharges from nine Pantex Plant facilities and the Plant Wastewater Treatment Facility (WWTF) are currently sampled for a variety of hazardous constituents and radionuclides. These facilities, listed in Table B.1, have been selected for liquid-effluent sampling based upon their operations, past results of effluent sampling, and regulatory requirements. Liquid effluents from one building may be sampled elsewhere, as is the case for effluents from Buildings 12-78 and 12-24 N, which are sampled at 12-43, and effluents from 11-20, sampled at 11-44. Building 11-44 is inactive and no liquid effluents originate there other than rainwater runoff.

B.1 Building 12-17

Building 12-17 has been used since 1952 for production activities to press high explosives into discrete shapes and to assemble small high-explosive (HE) components (Alley 1991). This building is also used to support an extrudable HE formulation process conducted in another building at Pantex Plant. A schematic of operations in Building 12-17 is shown in Figure B.1. Due to the construction of this building, the operations are divided between the north side and south side, each with its own wastewater discharge conduit (ditch).

Table B.1 Summary of Current Operations for Buildings with Sampled Liquid Effluent Streams

Building	Building Operations
12-17	HE pressing and assembly
12-19	HE formulation
12-24	HE non-destructive examination, mock and HE machining
12-43	HE wastewater filter building
12-78	Mock and HE machining
11-20	HE pressing
11-36	HE synthesis; vacuum vessels
11-44	Inactive, formerly an HE filter building
11-50	Mock and HE machining
WWTF	Sanitary sewage treatment

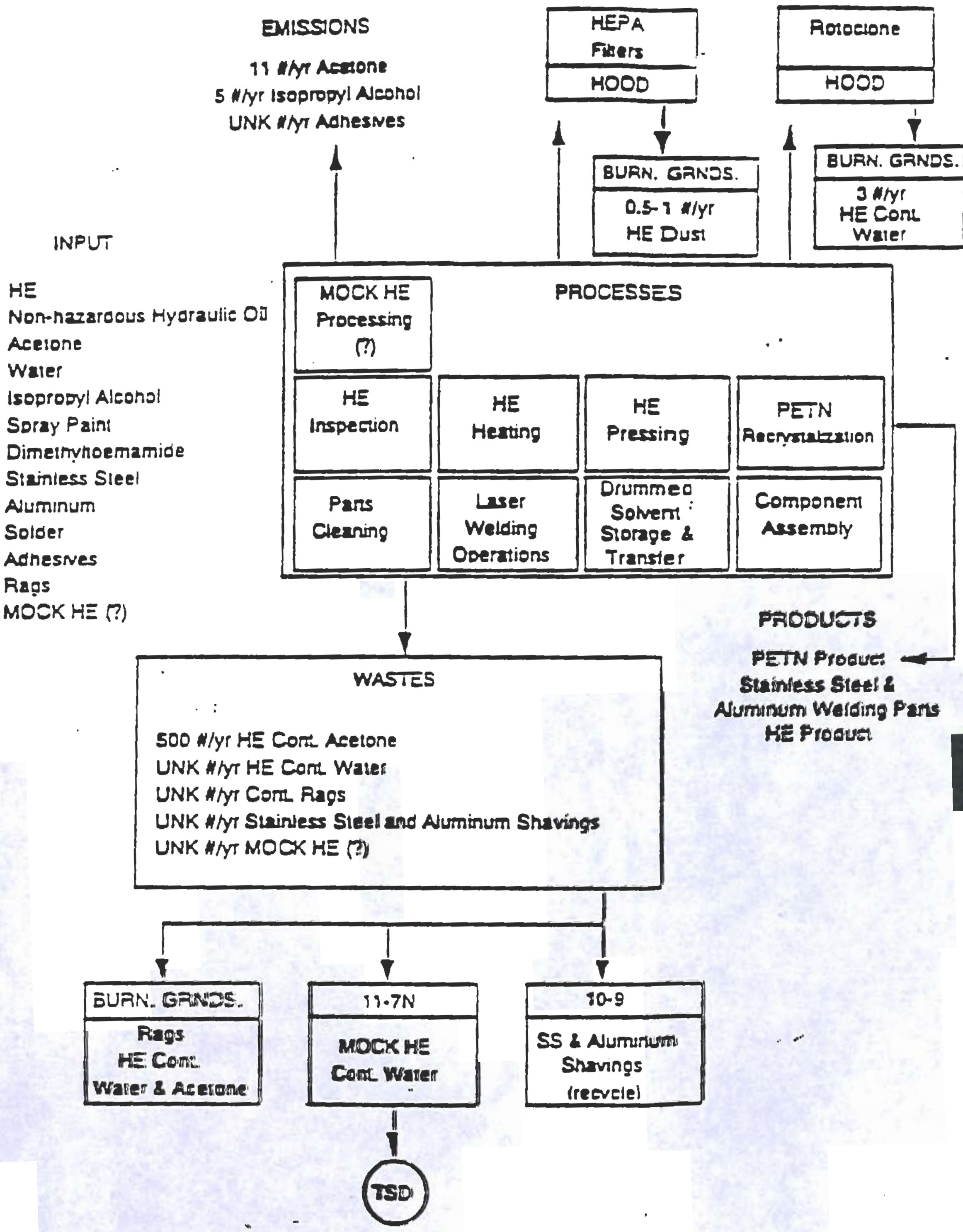

Figure B.1 **High Explosives Inspection, Heating, and Pressing in Building 12-17** (Source: Waste Management Department. 1991. "Waste Stream Identification Flowcharts." Draft. Mason & Hanger-Silas Mason Co., Inc., Amarillo, Texas.)

In the conduct of past operations, wastewaters contaminated with HE were generated, filtered, and discharged to an unlined ditch. When solvents are used in conjunction with the operations in this building, the operations were and still are conducted in such a manner as to prevent solvents from being introduced into the wastewater streams.

Process procedures were changed in August 1989, in conjunction with analytical tests of the aqueous waste streams discharged from Building 12-17. These changes resulted in the cessation of the contaminated industrial aqueous waste streams from the north side of the building first. In December 1990 discharges from the south side of the building were stopped.

Currently, the only aqueous waste streams being discharged from Building 12-17 are steam condensate, rainwater runoff from the roof of the building, and non-process water in the outside drainage ditches associated with the building.

A review of the chemicals added to the boiler plant make-up water has shown that the steam condensate is not a hazardous waste nor does it contain a hazardous waste constituent. The originating steam is used for area heating; thus, it does not come into contact with any other industrial process.

Stormwater from the roof flows onto a concrete apron and through two channels that run along the north and south sides of the building. Liquid effluents from operating bays in the building also discharge into these channels. These two channels discharge through Parshall flumes, for flow measurements, and into ditches at the east end of the building. When there is no precipitation or runoff, samples are collected from the channels and downstream ditches to represent actual plant flows and contaminants. During and following precipitation events, samples can be taken from these same locations and will reflect the influence of stormwater and any associated contaminants. The ditches ultimately conduct building discharge and stormwater to Playa One.

B.2 Building 12-19

Current operations in Building 12-19 East (Mason & Hanger 1991) are the formulation of plastic-bonded explosives and mock explosives, and molding operations. Current operations in Building 12-19 are shown schematically in Figure B.2.

Building 12-19 was constructed during World War II and was first used in 1952 as a melt-and-pour facility. This building has since been used as a mechanical assembly facility, as an HE formulation facility, and as a laboratory for gas analysis.

As a melt-and-pour facility, Building 12-19 was used for producing HE components for assembly into weapons. The HE used in these early days was based on mixtures of trinitrotoluene (TNT) and other components added to effect special properties (i.e., lower melting points or slower detonation velocities). These other components included research-developed explosive (RDX), barium nitrate, and boric acid. The HEs used most often in this building were mixtures of TNT and RDX. In some of these processes, acetone was used to soften the surface of the cast parts for overcasting operations that involved the repairing of voids and cracks in the explosive components.

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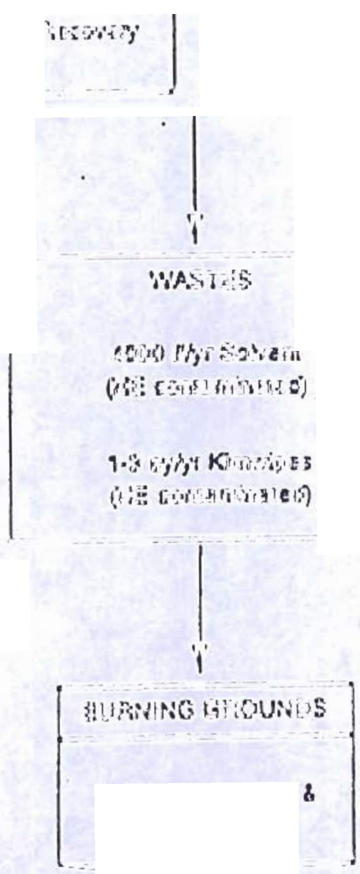

Figure B.2 High Explosives Pr 19E (Source: Wa

Stream Identification Flow nger-Silas Mason C

At the end of each day, the doors to the building were opened, and residual HE and other materials that had spilled on the floor were washed out the doors into the channels adjacent to the building. This is one of the historical sources of TNT that dyed Playa One a red/pink color and resulted in its name "Red Lake." The casting (melt-and-pour) operation ceased about 1961.

Following cessation of the casting operation in 1961, the west end of 12-19 was devoted to "type" assembly (non-nuclear test units). This was a mechanical assembly process and did not result in an aqueous wastestream being released from the building.

About 1963 or 1964, the Explosive Technology Division started HE formulation operations in the east half of Building 12-19. Crystalline HE particles were coated with organic binders: first, the binder was dissolved in organic solvents; second, the binder/solvent solution was mixed with HE particles; and third, the organic solvent was evaporated, causing the binder to coat the HE particles and form agglomerates. The evaporated solvents were released to a stack or via the water curtains, into the channels on the sides of the building. In 1988, the west end of Building 12-19 was assigned to the Gas Laboratory and it is currently used for weapons-component aging studies and mass spectrometry analyses. No aqueous waste streams are currently discharged from this operation.

The only aqueous waste streams discharged from Building 12-19 are steam condensate, non-contact cooling waters, and rainwater runoff from the building roof. The constituents used in the building are listed in Table B.2. No chemical reactions are known to occur between the binder and the solvents; therefore, there are no by-products produced as a result of the binder/solvent combination.

There are two liquid effluent discharge locations for Building 12-19. The first is the north discharge ditch from Building 12-19. The effluent is sampled where the concrete-lined channel passes under the north ramp and discharges into the unlined ditch. The second discharge location is the south discharge ditch from Building 12-19. This effluent is sampled at the point where the concrete-lined channel passes under the south ramp and discharges into the unlined ditch.

B.3 Building 12-24

Operations in Building 12-24 are machining of HE, mock explosives, epoxy, and Plexiglas. Wastewater from machining operations is sent to Building 12-43. Current operations in Building 12-24 are shown in Figure B.3.

Zone 12 was completed at the end of World War II and was not used for ordnance production during the war. Building 12-24 was activated in the latter part of 1952, becoming one of the original production buildings. The building was divided into two parts: 12-24N (north) was converted into the production HE machining facility, and 12-24S (south) was used as an assembly facility. There were no liquid discharges from 12-24S, as the operations conducted in this end of the building were of a mechanical assembly type.

High explosives machined in the building include HMX-based and TATB-based plastic-bonded explosives (PBXs). Also, mock HE and Lucite are machined during fixture set-up operations. The mocks contain various combinations of melamine, cyanuric acid, barium nitrate, boric acid, nitrocellulose, Viton A (a chlorofluoropolymer), pentaerythritol, and talc. In the past, TNT-based explosives were machined here.

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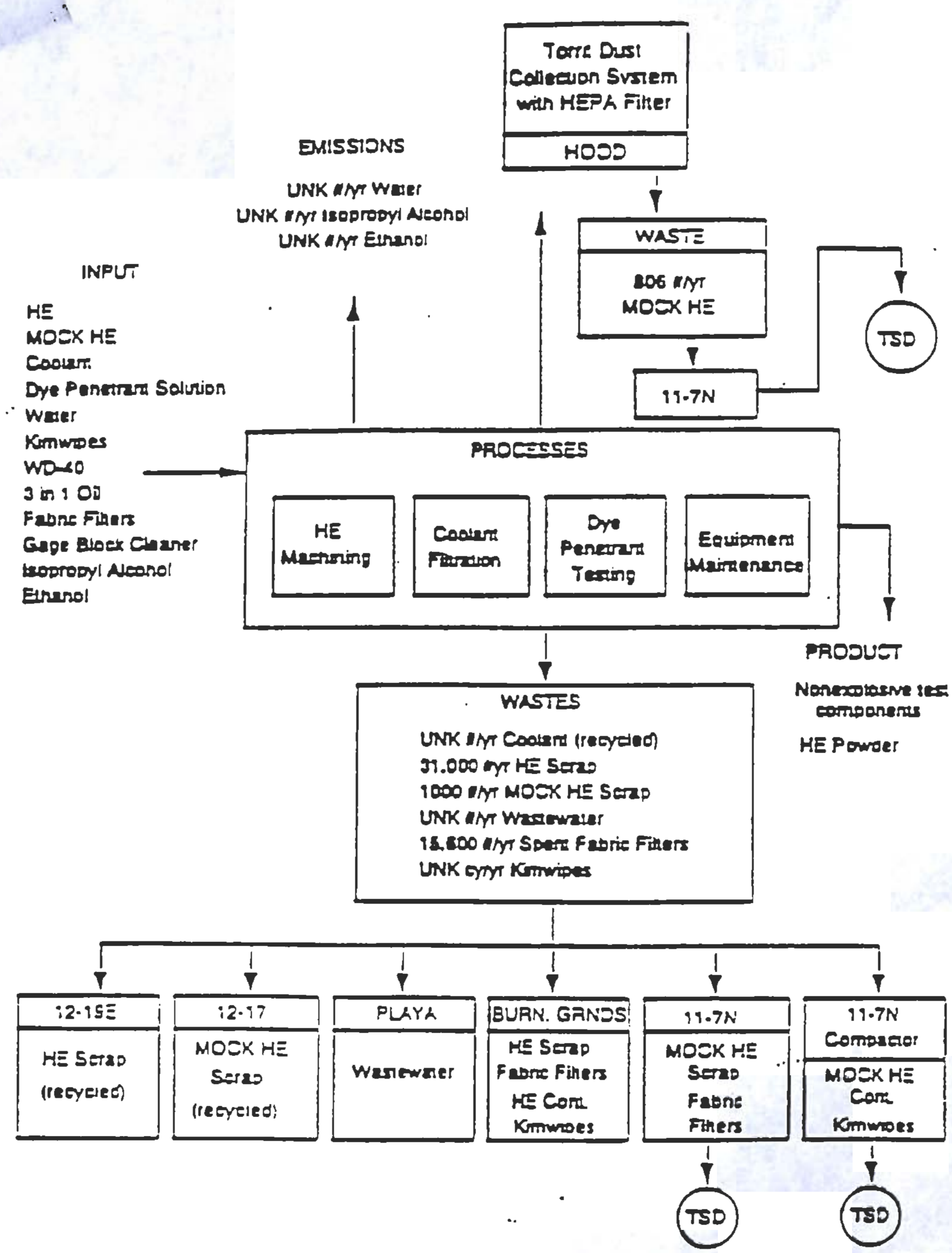

Figure B.3 High Explosives Machining in Building 12-24 (Source: Waste Management Department. 1991. "Waste Stream Identification Flowcharts." Draft. Mason & Hanger-Silas Mason Co., Inc., Amarillo, Texas.)

Very few solvents are used in the building, as organic solvents could dissolve the HE-finished surfaces of machined parts and destroy their usefulness. However, small quantities of isopropyl alcohol are used in the operations. Any solvent in the cooling water discharge would pass through the particulate filters.

Channels on the north and south sides of the building collect HE machining water from the HE machining bays in 12-24N. The water and any suspended HE is collected in a sump on the east end of the building and pumped through an overhead flume to Building 12-43.

B.4 Building 12-43

Building 12-43 is an HE filter building for liquid waste streams coming from buildings 12-24N and 12-78 (Mason & Hanger 1991). Treatment operations at Building 12-43 began in late 1950 using a tank to separate, via gravity, HE from the wastewater streams from Buildings 12-24 and 12-78, where HE and mock plastic-bonded explosives formulations are machined. The discharge from Building 12-43 is filtered wastewater from Buildings 12-24N and 12-78, rainwater runoff, and steam condensate.

The treatment process has been upgraded over the years with the addition of a second tank, particulate filtration, and carbon adsorption. The tanks and ancillary piping connecting the tanks were declared a hazardous waste treatment unit and were included in various permit applications to the regulatory agencies of the State of Texas. The treatment operation in the tanks and ancillary piping connecting the tanks continued until April 1990. At that time, operational and physical changes were made.

The aqueous wastestreams now go through additional filtration at the point of generation. The current filtration removes about 99 percent of the particulates in the machining area. The initial filtrate is routed through a collection system that takes it to Building 12-43, where it is pumped through pressure particulate filters and activated carbon adsorption filters. A process change was also made in the dye penetrant operation in Building 12-24. The penetrant operation was reformulated to eliminate water-soluble solvents from the waste streams. The aqueous waste streams are then discharged outside of the building.

With these changes to the operations, the aqueous waste streams treated in Building 12-43 are no longer characterized as hazardous. Table B.2 lists the constituents that are used in Buildings 12-24N and 12-78.

The point of discharge for Building 12-43 is a steel pipe exiting the west side of the building, where it discharges into a concrete-lined channel. The liquid effluent stream is sampled at this location. Effluent from the channel is discharged to the unlined ditch system that empties at Playa One. The dewatered HE slurry is moved to the Burning Ground for disposal by open burning.

B.5 Building 12-78

Building 12-78 houses remote machining operations on HE, mock explosives, epoxy, and Plexiglas - the same material as is used in Building 12-24. Process wastewater from machining operations is sent to Building 12-43.

Building 12-78 was built in 1982-83, as an adjunct to 12-24N. Operations in the building include a hole-drilling operation for explosive parts made of high-melting explosive (HMX). This operation was segregated from other machining operations because the mechanical heat of drilling is concentrated in a very small area, which means an inherently high risk. The lathe operation used in 12-24N spreads the heat over the total surface of the HE piece.

Discharge of the HE machining water from the building is via a sump and pump on the north side of the building to an overhead flume flowing to the filter equipment used in filtering the 12-24N discharge. As in Building 12-24N, virtually no solvent is used in the building.

B.6 Building 11-20

Building 11-20 is currently used as an HE pressing facility (four bays - one heating bay and three press bays) and an HE machining facility (one bay) for HE development and research. Other operations in the building include physical properties testing (compression testing and tensile testing) and small-component test firing. These last operations do not result in liquid discharges. Building 11-20 was constructed during World War II and used either for final finishing work on ordnance or as a loading facility for the finished product. Following World War II, the building was reactivated about 1959 under the Atomic Energy Commission (AEC) and began its current operations. Current operations in Building 11-20 are shown in Figure B.4.

Initially, cooling water from the HE machining operation was discharged into an earthen-lined holding pond located on the east side of the building. Types of HE processed in the facilities and possibly discharged to the pond in the cooling water include TNT, cyclotol and Comp B-types (mixtures of TNT, RDX, barium nitrate, and boric acid), HMX-based PBXs, and pentaerythritol tetranitrate (PETN). Cooling water discharge to the pond was changed in 1965-67 to the current effluent discharge scheme. Solvents and other organics used in the building include acetone, trichloroethylene, alcohols, water-miscible oils, and hydraulic oils.

The machining wastewater from Building 11-20 operations is directed to Building 11-44 through a concrete flume on the east side of the building. In addition to normal sanitary waste, a sink used for washing machining oil from metal and plastic parts discharges into the sanitary sewer.

B.7 Building 11-36

Building 11-36 is currently used for pilot-plant HE synthesis activities as part of the Pantex Plant HE development and research program. Current operations in Building 11-36 are shown in Figure B.5.

Building 11-36 appears to have been used in World War II as a receiving and inspection facility for bulk HE, which was then moved to Building 11-13 for melting and casting operations. Under the AEC, it was modified in about 1972 for use as an pilot-scale HE synthesis facility. In 1977, it was upgraded, with the addition of tanks for fuming nitric acid and hydrochloric acid, underground solvent tanks, associated transfer lines and header tanks, an acid gas scrubber system, and a flume and sump for moving aqueous wastes to a Hypalon-lined pond near Building 11-14. Prior to installation of the pond, discharges (including acid wastes from the nitration step and solvent-contaminated waters from washing operations) from the building flowed southwest from the west side of the building to Playa Two. Bulk solvents from the synthesis operations were barreled and sent to the Burning Ground for disposal in unlined pits. Currently, no wastes are discharged; periodic samples of stormwater runoff are obtained.

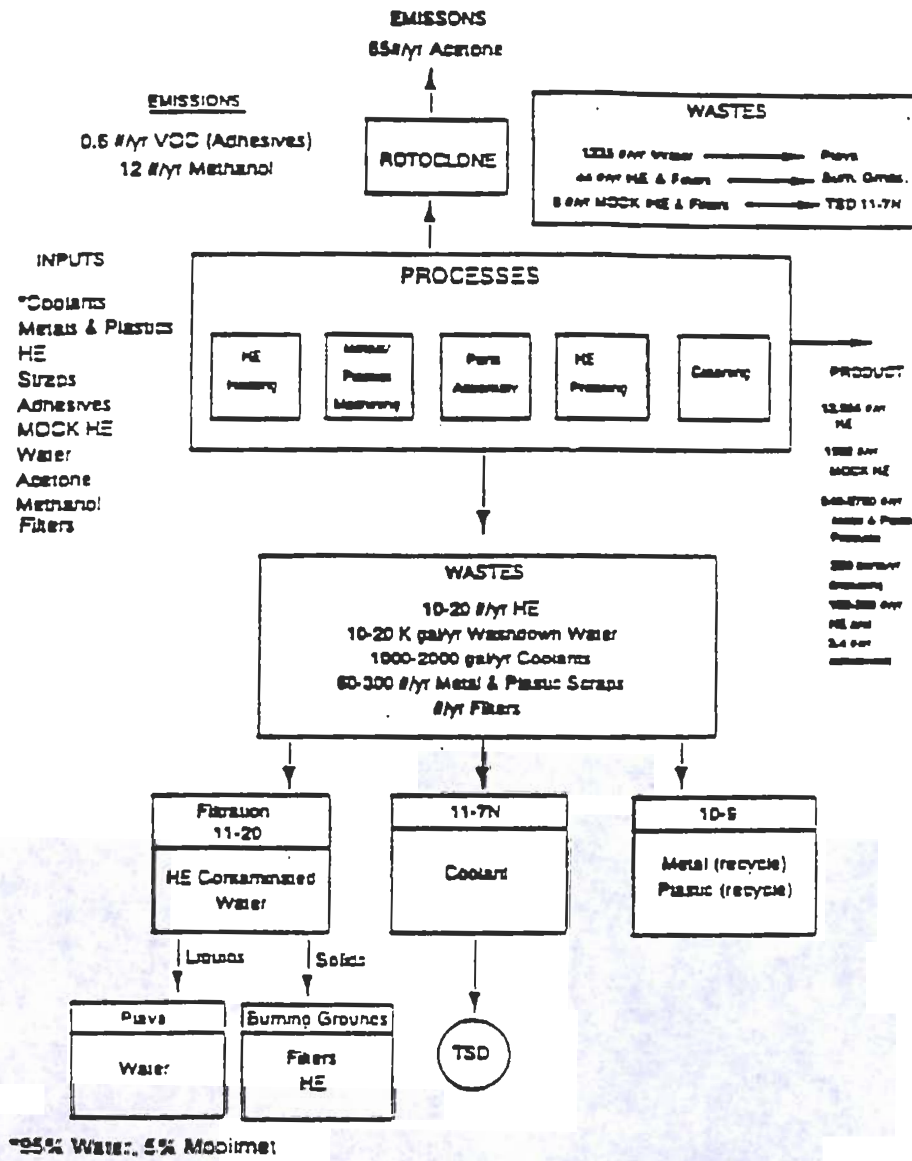

Figure B.4 **Machining and High Explosives Pressing in Building 11-20** (Source: Waste Management Department. 1991. "Waste Stream Identification Flowcharts." Draft. Mason & Hanger-Silas Mason Co., Inc., Amarillo, Texas.)

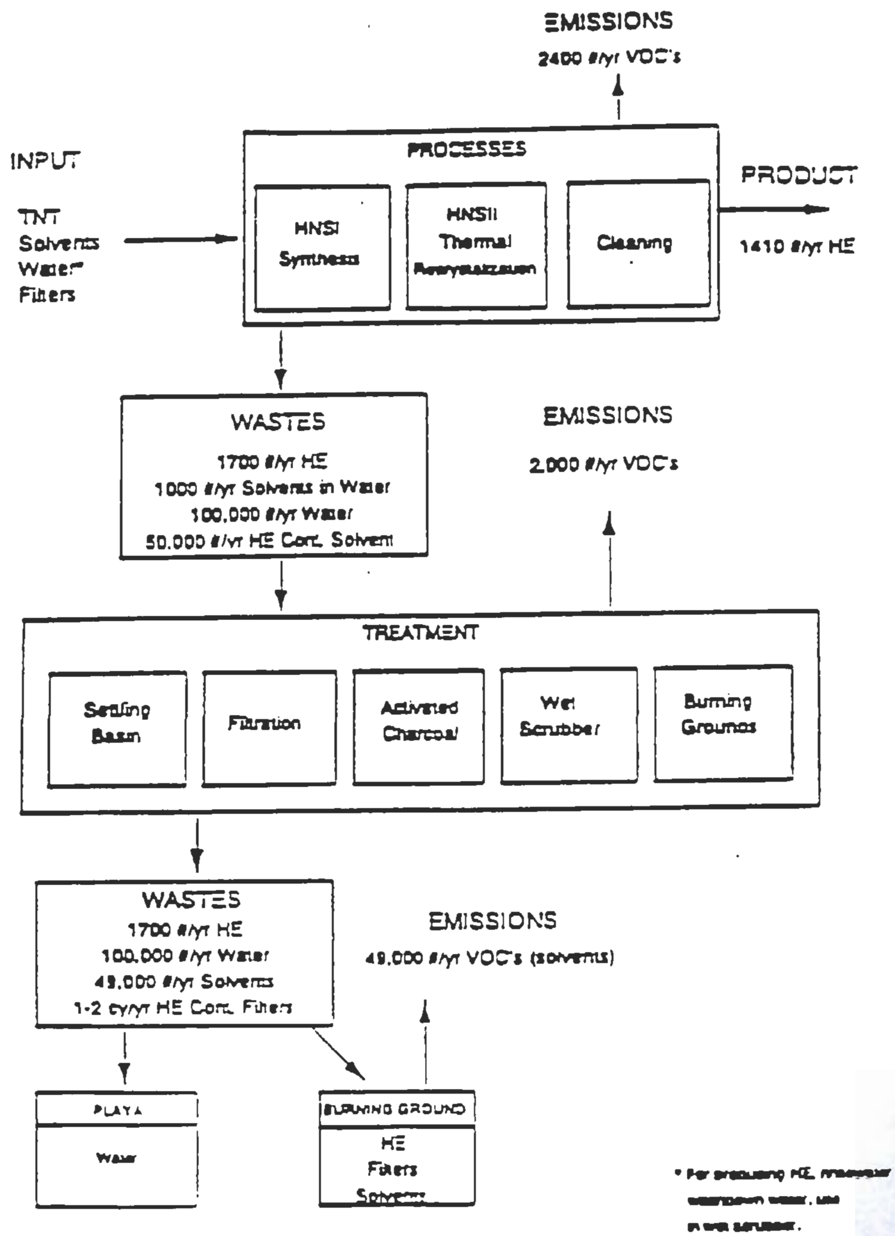

Figure B.5 High Explosives Processing in Building 11-36 (Source: Waste Management Department. 1991. "Waste Stream Identification Flowcharts." Draft. Mason & Hanger-Silas Mason Co., Inc., Amarillo, Texas.)

Products produced in the facility include sym-triamino-trinitrobenzene (TATB); trichloro-trinitrobenzene (TCTNB), a precursor of TATB; hexanitroazobenzene (HNAB); hexanitrohydrazobenzene (HNHB); hexanitrostilbene (HN); and benzo-trifuroxane (BTF). Small quantities of the PETN homologs were also produced in the facility.

Solvents used in the synthesis operations include toluene, methylene chloride, pyridine, ethanol, hexane, acetonitrile, acetic anhydride, methanol, tetrahydrofurane, dioxane, and dimethylformamide. The solvent used in greatest quantity was toluene.

Incidental discharge is through a concrete-lined flume on the west side of the building to an unlined ditch that goes west to Playa Two. Liquid wastes entering the sewer lines from this building include steam condensate, sanitary waste, and non-contact cooling water from the reactor jackets.

B.8 Building 11-44

The name "Building 11-44" is used at the Pantex Plant to identify not just the building but also two tanks and the ancillary pumps and piping located in and adjacent to Building 11-44. In November 1989, the Pantex Plant ceased the flow of all aqueous waste streams to these tanks. The facility is currently inactive and used only as a liquid effluent sampling site.

The tanks at this building were used to treat wastewaters containing HE by gravity settling followed by passing the waste stream through string and carbon filters. Building 11-44 was built in 1965-67 to filter HE particulates from the HE machining operations in Buildings 11-14 and 11-20. The operation consisted of a two-stage filter: the first stage was a settling cone, and the second stage was a string-wound particulate filter. The filtered water was pumped from the secondary filter to a concrete flume on the north side of the building. The water flowed by gravity from the east end of the flume into a drainage ditch to Playa One. In 1987, an activated carbon filter was installed in the system to remove dissolved HE from the filtered water. The filtering operation in this building has been shut down since the HE machining operation for Explosive Technology Division was moved to Building 11-50.

A review of the chemicals added to the steam condensate (which is distilled water) has shown that the steam condensate is not a hazardous waste, nor does it contain a hazardous waste constituent. The originating steam is used for area heating; thus, it does not come into contact with any other industrial process.

Since the time waste activities ceased, wastewater formerly treated at this site has been treated at the point of generation. At the current time, the only aqueous waste streams being discharged from Building 11-44 are stormwater runoff and steam condensate. The stormwater runoff does not come in contact with any industrial processes and, thus, is not contaminated with any of the constituents generated by these operations. The ditch near Building 11-44 is used as a liquid effluent sampling site for periodic effluents, to which Building 11-20 occasionally contributes.

B.9 Building 11-50

Building 11-50 became operational in the fall of 1985 (Mason & Hanger 1991). The operations in this building are the machining of pressed plastic-bonded explosives and mock plastic-bonded materials into finished components (Figure B.6). There is also some machining of Plexiglas and polycarbonate. In the

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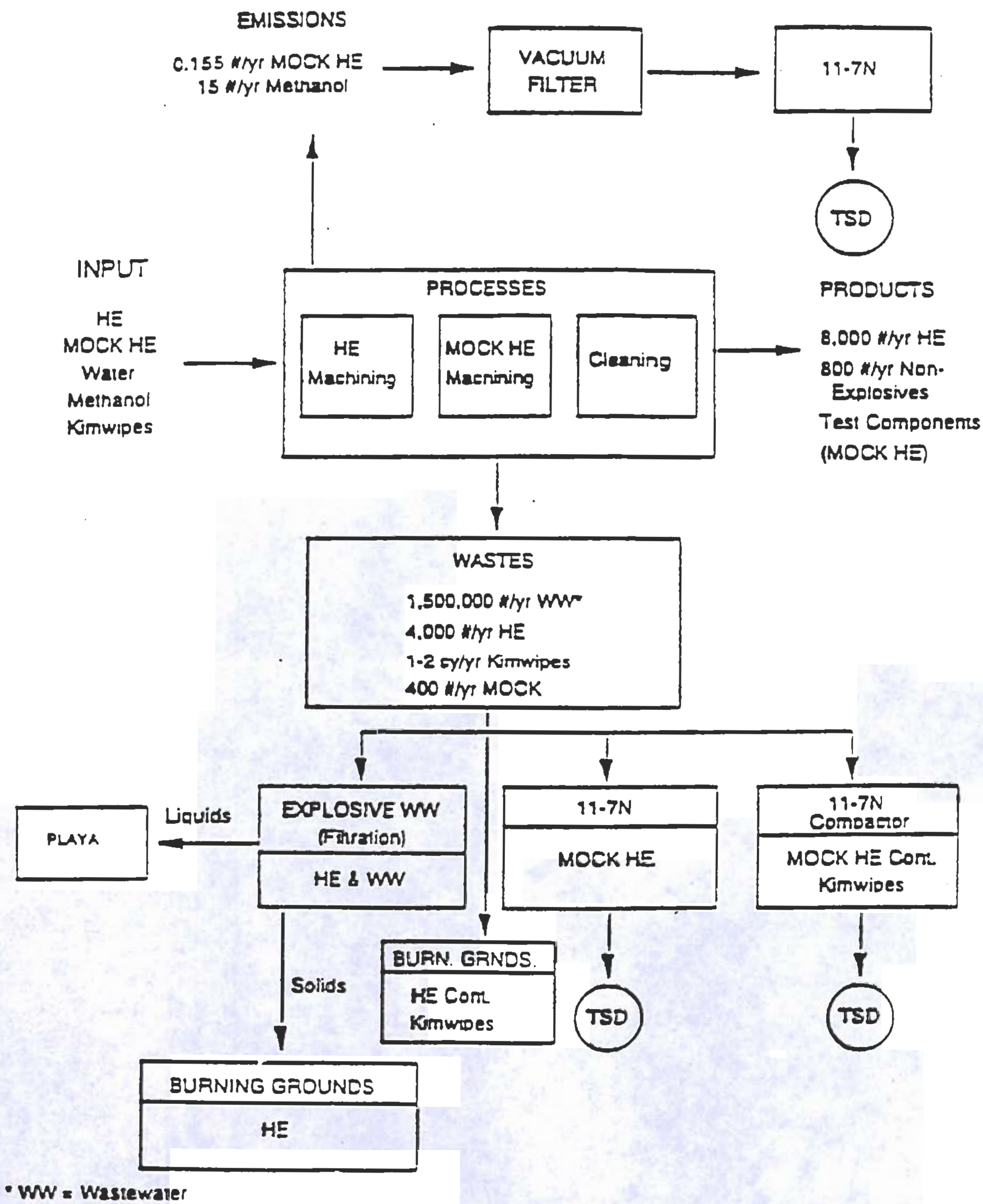

Figure B.6 Building 11-50, HE and Mock HE Machining